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HAMILTON

BRITISH
MAMMALS

LAGOMORPHA

RODENTIA.

RODENTS.

Characters:—These are mammals which have no canines, and in which the most prominent and unmistakable character is formed by the large, curved, chisel-shaped, rootless **incisors**, which often have their anterior surfaces yellow or red, and are separated by a long space or diastema from the cheek-teeth, the crowns of which may be tuberculated or laminated. In the **skull** there are zygomatic arches, the central portions formed by the malar bones, and auditory bullæ; the orbits communicate freely with the temporal fossæ; the lachrymal foramina are always within the margin of the orbits, and there are no postglenoid processes to the squamosals. In the mandible the condyle is elongated from before backwards, so that the jaw can be moved backwards and forwards; the symphyseal portion is abruptly narrowed and rounded in support of the large incisors, the coronoid process is small and the angular part greatly developed. The radius and ulna are separated; the ischia and pubis are well developed and meet in a long symphysis. The mouth is divided into two cavities; the testes are abdominal or inguinal, becoming more prominent during the rutting season; there are prostatic glands and, except in the *Duplicidentata*, vesiculæ seminales; the uterus is two-horned; the placenta is discoidal and deciduate; the cerebral hemispheres are smooth, and do not extend backwards far enough to cover any part of the cerebellum; the temporal muscle is comparatively small, the masseter large and double.

This great and well-defined order, which in number of species far exceeds all the others, dates from the Lower Eocene

of America and the Middle Eocene of Europe, and possibly had its origin in the Northern Hemisphere (Osborn).

Its members are now found naturally throughout the whole world, excepting only New Zealand and Oceanic Islands, where, however, many introductions have taken place of *Oryctolagus*, *Epinys*, and *Mus*.

Although sharply defined as regards structure, the order includes a great variety of types, displaying very different habits and existing under a great diversity of conditions. Some are burrowers, climbers, swimmers, or jumpers; others are cursorial, sedentary, or, being provided with parachutes of skin, appear to be in a fair way to attack the problems of flight. With the exception of the actual oceans, there are few parts of the world's surface where rodents have not secured a foothold, and they exist in one form or another in almost all types of country; being found from the eternal snows of the lofty mountain ranges to the swamps of the great rivers, and from the frozen lands of the north polar basin to the vast burning sand deserts.

By nature primarily herbivorous, they differ from the other great order of herbivorous mammals, the Ungulata, in the fact that they rarely attain to any considerable size. To this fact, together with their extreme fertility and their general readiness to adapt themselves to an omnivorous, to an insectivorous, or even a carnivorous diet, they probably owe the secret of their success as an order, but it should be noted that some species are absolutely restricted to vegetarianism.

All the British representatives give birth to several young at a time, and, usually, to more than one litter in a season, so that, under favourable conditions, their increase is rapid. Except in the case of the hares, all British rodents are born in an undeveloped and helpless state, and are at first well cared for in a warm nest, placed often in an underground tunnel constructed by the mother, and frequently lined with wool or hair plucked from her own belly. The cavies or guinea-pigs, only known in Britain in captivity as domesticated varieties, probably represent the extreme of mammalian precocity, since they will eat cabbage within half an hour of their birth. All grow with great rapidity, and breed as soon as, or before, they are full grown.

They may be gregarious, sociable, or solitary, and the majority seem to be polygamous. Some, like the Squirrel, are monogamous, but they may change their mate at the end of a season.

Many species have been regularly kept in confinement either for their beauty, as the squirrels, rats or mice, or for the use of their fur and flesh, as the Rabbit. All but the first have now been so thoroughly domesticated that there are many distinct artificial breeds in existence; which, however, are quite fertile with each other or with the wild form. Many wild species of rats and mice may also without much difficulty be induced to breed in captivity, but the hares are not easily managed unless they are provided with a run on grass. The Common Squirrel, although it thrives well in confinement, has only been known to produce young in a very few instances, and never in the second generation.

Rodents are subjects of somewhat varied attention by humanity in general, since (to take British examples only) the hares and rabbits are of special interest to the sportsman, the cook, and the furrier; the rats and mice, except by those who keep them as pets, are commonly regarded as vermin. On the other hand, the extinct Beaver was the possessor of most interesting habits, as well as of fur so super-excellent as to be its own undoing; the Squirrel and Dormouse will always attract attention by their beauty and graceful agility. Apart from the utility of the hares and the rabbits as food and objects of the chase, and the value of their fur, as well as of that of the Beaver and Squirrel, little can be said in praise of any British rodent from an economical point of view. The Dormouse alone is innocuous. The Squirrel will be shown to be injurious to woods. All the hares, the rabbits, and the whole tribe of rats and mice are in varying degrees directly harmful to agriculturists, and the Common Rat and Mouse live almost entirely at the expense of man. This is the case especially in England, where their natural enemies, four-footed and winged, have been to so great an extent exterminated by game-preservers. Occasionally under these circumstances one or other of the smaller murines may become so numerous as to occasion what is called a "plague," details

of which will be given under the various species. The Common Rat, as well as some exotic species, have recently attained an even more unenviable notoriety, since the discovery that they are the bearers of the disease of the above name to human beings.

From the point of view of the philosophical naturalist, the rodents are in many ways the most attractive order of British mammals. They usually possess a high degree of beauty, both in form and colour, and within their own limits their variety is almost infinite. It is noticeable, for instance, that the order is so plastic that it includes within its ranks several species and sub-species peculiar to Britain. The history of all of these is of special interest.

Amongst the mice there are distinct representatives of specific or sub-specific value in Fair Island, the Orkneys, St Kilda, the Outer Hebrides, and Skomer Island. Almost all the other small rodents of Britain are sub-specifically distinguishable from their representatives on the continent of Europe.

In the matter of pelage the rodents are in many ways remarkable. The varying hares afford conspicuous instances of the phenomenon of winter whitening, the Squirrel of bleaching and of a complicated system of moults, the water and true rats of a tendency to melanism.¹ In some families, as in the *Leporidae* and the South American chinchillas, the fur is of very fine texture, but in other forms it is replaced by spines on the back, the most extreme instance being that of the (non-British) porcupines.

The Dormouse is subject to hibernation. The Brown Rat and House-Mouse are so closely attached to man as to be almost domestic. The former is admittedly a recent arrival, yet the locality of its origin is unknown. The Rabbit is also not indigenous, although known at least from the twelfth century.

A number of other rodents inhabited the British Islands in past geological ages, and some of these are still represented by their descendants on the continent of Europe.

Structure:—The prominent cutting **incisors** often excite interest by the remarkable deformities or abnormalities which they undergo when injured. Since the pulp is persistent, these

¹ See also, for the colour of certain exotic squirrels, below under genus *Sciurus*.

teeth continue to grow throughout life. They are strongly curved, especially those of the upper jaw, and are so arranged in opposition as to wear away their cutting surfaces one against the other. If one happens to be broken, great disturbances result. The corresponding tooth in the opposite jaw, having no means of wearing away its cutting edge and finding its growth unchecked, continues to push its head forwards in a circle or spiral, until it may eventually kill the unfortunate animal, either by penetration or starvation resulting from inability to feed. A good figure of such a case occurring in a rabbit was published by Tegetmeier in the *Field*, 8th March 1890, 360.

The two **cavities of the mouth** are formed by a folding inwards of the hairy skin of the face behind the incisors. Thus these teeth when engaged in gnawing through an obstacle do not fill the mouth with inedible or objectionable material, as happens when a dog or other animal with a simple mouth uses its teeth to remove roots or soil.

Classification :—The surviving British members of the order as here arranged fall into four families :—*Leporidae*, containing the hares and rabbits ; *Muscardinidae*, the dormice ; *Muridae*, the mice, rats, and their allies ; *Sciuridae*, the squirrels ; and a fifth, the *Castoridae*, containing the beavers, of which a British representative only became extinct in early historical times. The above families are usually grouped in two main divisions or sub-orders. Of these the *Duplicidentata*, including only, amongst living British rodents, the *Leporidae*, have always two pairs of upper incisors. The second division, that of the *Simplidentata*, includes all British rodents except the *Leporidae*, and its members are easily recognised by their single pair of these teeth. No rodent possesses more than a single pair of mandibular incisors.

An older arrangement whereby the order was divided into groups, each of higher rank than a family, such as *Lagomorpha* or leporines, *Myomorpha* or murines, and *Sciuromorpha* or squirrel-like rodents, has been superseded as being in many ways unnatural and unsatisfactory. Under it, for instance, the dormice must necessarily be placed either with the mice or the squirrels, in either case an unnatural alliance.

DUPLICIDENTATA.

These are rodents distinguished from all other members of their order by the possession throughout life of four upper incisors, in which the enamel extends round to the posterior surface. Two of these are of the ordinary type, but large and heavy; the other two are minute, and, lying behind the larger ones, are concealed from view; a third outer pair is present at birth, but persists for only a short time. The grinding teeth are so arranged that the motion of the jaws in eating is from side to side (see below, description of hares). The incisive foramina are very large and posteriorly confluent, and the bony palate is so reduced as to appear as at most a narrow bridge lying between the premolars.

There are two families, the *Ochotonidæ*, the pikas, tailless- or mouse-hares, and the *Leporidaæ*, or hares and rabbits.

[OCHOTONIDÆ.¹

PIKAS OR MOUSE-HARES.

These are represented in Britain only by an extinct species, *Ochotona*² *spelæa*,³ the bones of which occur in the latest pleistocene cavern deposits.

A member of the family, *O. pusilla* (Pallas), still inhabits the Ural Mountains, and ranges from the Volga to Turkestan and Western Siberia. Other forms are found through Asia to the mountains of western North America.

For our knowledge of the early history and evolution of the *Ochotonidæ* we are principally indebted to Forsyth Major's paper, published in the *Trans. Linnean Soc.* (London), *Zool.*, Nov. 1899, 433-520. The group is first met with in the lower miocene deposits of Western Europe, in which region

¹ Extinct in Britain.

² Of Link, 1795, antedating *Lagomys*, Cuvier, 1800.

³ *Lagomys spelæus*, Owen, *British Fossil Mammals, etc.*, 1846, 213, figs. 82-4.

it not improbably had its origin. At a later date it spread eastwards, and appears to have first found its way to America by way of Asia in the pleistocene period.

The Pikas are about the size of guinea-pigs, and are chiefly found in mountains, where they live in holes in rocks. The living forms differ from the hares in having all four limbs of about equal length, in their short ears, and in the absence of a tail. In the generally depressed skull the contracted frontals are without postorbital processes; the malar bones are drawn out in very long processes behind the zygomatic processes of the squamosals, and more than half of the bony palate is formed by the palatine bones. The clavicles are complete.

The Pikas differ from almost all *Leporidæ* in having only five upper cheek-teeth instead of six; in the mandible there are five or four cheek-teeth. The anterior three of these teeth in the upper, the anterior two in the lower jaw always replace deciduous predecessors, and are therefore premolars. In this the *Ochotonidæ* agree with the *Leporidæ*; and the tooth that is constantly missing is the last upper molar (m_3), but in some forms the last lower molar (m_3) disappears as well. The dental formula of the *Ochotonidæ* is therefore:—

$$i \frac{2-2}{1-1}, \quad c \frac{0-0}{0-0}, \quad pm \frac{3-3}{2-2}, \quad m \frac{2-2}{2-2 \text{ or } 3-3} = 24 \text{ or } 26;$$

that of the *Leporidæ* normally:—

$$i \frac{2-2}{1-1}, \quad c \frac{0-0}{0-0}, \quad pm \frac{3-3}{2-2}, \quad m \frac{3-3}{3-3} = 28.$$

The suppression of m_3 is a very ancient feature of the *Ochotonidæ*, since it is already seen in the oldest known form, viz., *Titanomys visenoviensis* of von Meyer from the lower miocene. In a middle miocene successor, *T. fontanessi* of Depéret, the last lower molar (m_3) also disappears in adults, and this tooth is entirely suppressed in *Prolagus* (middle miocene to pleistocene). The genera *Lagopsis* (middle miocene) and *Ochotona* (pleistocene and recent), although more specialised than *Prolagus* as regards the structure of the teeth, are more primitive in that they have retained m_3 ; this tooth being, of course, as elsewhere in Duplicidentata, much reduced.

The dental evolution, and especially that of the upper cheek-

teeth, is of considerable interest, and throws so much light on the teeth of other rodents that it may be described in some detail. In common with those of other primitive mammals the cheek-teeth of all the earliest Duplicidentata were short-crowned, or brachyodont, and provided with long and completely closed roots in the adults. As in other mammals, so (and nowhere more strikingly) in the Rodentia—one of the principal directions of dental advance has been that leading to hypsodonty, or long crowns, and persistent growth. In the lower miocene period the *Ochotonidæ* had already made substantial progress along this line. The anterior view of an upper molar of *Titanomys visenoviensis* is given in Fig. 29, No. 1a. The outer part of the crown is very low, or brachyodont, and it is supported on two small centrally placed and completely closed roots, of which one is seen in the drawing. The inner part is supported on a single large, but not quite closed root, and is greatly deepened by an extension of its enamel covering over part of the surface of the fang. The next stage is seen in the middle miocene *T. fontanessi*, wherein the brachyodont external part of the crown (No. 2) has atrophied; the small fangs are no longer central but external, and they remain longer unclosed. At the same time the inner part of the crown has become still higher or deeper, and the enamel has invested the whole of the inner face of the enlarged and now constantly open root. Eventually the small external roots are completely absorbed by the large inner one; the large internal root is itself transformed into part of the molar crown by the encroachment of the enamel sheet, and in the end we have the prismatic, persistently growing teeth of the living pikas, and the hares and rabbits. To-day the ancient rooted and brachyodont character is, among Duplicidentata, alone met with in their milk-molars, these being always more conservative than the permanent ones.

Another interesting set of changes call for a little notice, and is illustrated by Fig. 29. The cheek-teeth of *Ochotonidæ* and *Leporidæ* originally possessed a longitudinal pattern of enamel folds; this has been superseded by a transverse arrangement. An upper molar of *Titanomys* shows on its worn surface two crescentic enamel folds each filled with cement, and opening on the antero-external corner of the tooth (Fig.

29, No 1, *b* and *c*), and the inner border of the tooth is indented by a wide notch or groove (*a*), which extends down towards the root. In *Prolagus* the central upper premolar (Nos. 3, 4, *p*₃) shows what is substantially the same arrangement; but the posterior upper premolar (Nos. 3, 4, *p*₄) shows a change; in the latter the two crescentic enamel folds (*b* and *c*) have been converted into enamel islets, and the inner notch *a* has become a transverse fold, stretching half-way across the

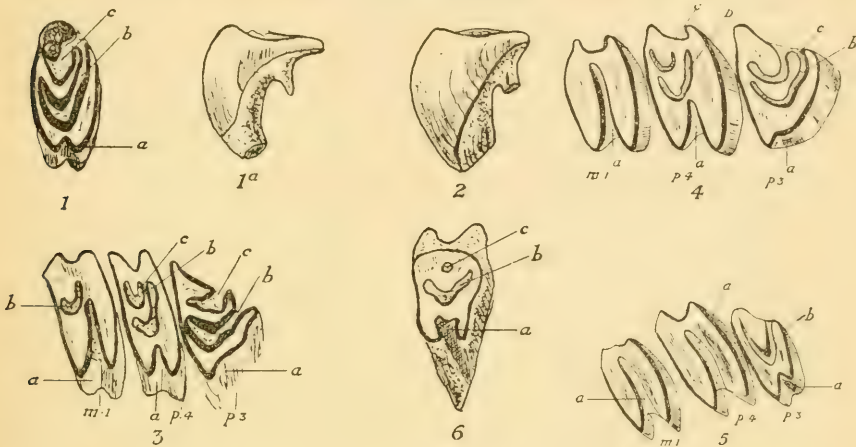


FIG. 29.—UPPER CHEEK TEETH OF *Duplicidentata*. 1, Grinding surface and, 1a, anterior view of a molar of *Titanomys visenoviensis* (lower miocene); 2, the corresponding tooth in *T. fontanessi* (middle miocene); 3, 4, 5, grinding surfaces of *p*₃, *p*₄, and *m*₁, in *Prolagus aeningensis* (middle miocene), *P. sardus corsicanus* (pleistocene), and *Ochotona spelæa* (pleistocene), respectively; 6, grinding surface of a worn milk molar of *Oryctolagus cuniculus* (recent). All represent right teeth; in Figs. 1, 3-6, the left and right sides are posterior and anterior respectively, the bottom and top are internal and external respectively; in 1a and 2 the right and left sides are internal and external respectively. (Drawn by M. A. C. Hinton; figs. 1, 2, 3, and 6 after Forsyth Major.)

tooth in *P. sardus* (No. 4). In the earlier species, *P. aeningensis* (No. 3), the anterior upper molar (*m*₁) has lost the outer crescentic fold *c* altogether in adult stages of wear, but the inner one *b* remains as an islet; the transverse fold *a* is still further developed than in the posterior upper premolar (*p*₄). In the pleistocene *P. sardus*, *m*₁ has lost both crescentic folds (No. 4), and the transverse fold *a* nearly reaches the outer border, as in the living pikas, and in the hares and rabbits. Thus it is shown that in the *Ochotonidæ* the anterior cheek-teeth are more conservative, the posterior ones more progressive, and the same holds good of the *Leporidæ*, and also of many other rodents.

In the middle miocene *Lagopsis* a still further advance is made, since the posterior upper premolar (p_4) has completely acquired the transverse arrangement; the central upper premolar (p_3) being also in course of reduction. In *Ochotona* (No. 5), the latter tooth, p_3 , in adult stages only retains the internal crescentic fold b , having completely lost the outer one. In *Leporidae* this tooth also is fully transformed, and only the anterior upper premolar (p_2) retains any permanent trace of the original pattern. Nevertheless, the milk-teeth, and the unworn crowns of even the permanent teeth, of these highly specialised modern forms still show ephemerally the ancient pattern which characterised the teeth of their miocene ancestors, as shown by No. 6, which represents a worn milk-molar of a rabbit.

Prolagus is in another way of great interest. It makes its first appearance in the middle miocene period, and species are known to occur in the lower and middle pliocene deposits of France and Italy. It is an extraordinary fact that a representative of this tertiary genus, *P. sardus*, managed to survive in the Mediterranean region until the pleistocene period. Remains of this rodent occur in great abundance in the bone breccias of Corsica and Sardinia, and nearly allied forms have been found in similar deposits on the shores of the Mediterranean at Gibraltar, Cette, Rattoneau, Nice, and Mentone. Forsyth Major proved indeed that in Corsica *P. sardus* survived sufficiently long to have formed part of the food of neolithic man.¹]

¹ *Prolagus*, Pomel, 1853, antedating *Myolagus*, Hensel, 1856. See Forsyth Major, *Geol. Mag.*, October and November 1905, where numerous references to the literature are given.

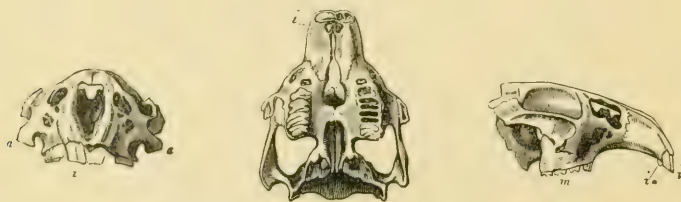


FIG. 30.—SKULL OF *Ochotona spelæa*, from Kent's Hole, Devon. (From Owen's *British Fossil Mammals*, figs. 82, 83, and 84, p. 213.)

LEPORIDÆ.

HARES AND RABBITS.

Characters:—These are duplicitent rodents, with long ears¹ and hind legs; with rudimentary clavicles; with the palatal bridge formed mainly by the maxillary bones; with superciliary processes to the frontals; with rather small auditory bullæ not inflated with spongy tissue with lateral mastication.

They appear to have had their **origin** in North America, where they are first known from the lower oligocene (*Palæolagus*). *Lepus* itself appears in the upper oligocene of North America, but is not found in Europe or Asia (Siwaliks) until the lower pliocene.

They are now widely distributed, being represented all over the world, except in New Zealand, Australasia, and Madagascar.

Classification:—This family formed until recently one genus, *Lepus*. It has latterly, however, like other groups, been compelled to yield to the attack of minute study, and the old Linnean genus has already been divided into about ten modern genera, including many species and sub-species.

The first and most obvious segregation was that of Forsyth Major, who, in the *Trans. Linnean Soc.* (London), *Zool.*, Nov. 1899, 514, 1900, placed the hares and rabbits in two super-generic groups. One containing the genus *Lepus* included the brown hares and their allies of Europe and Asia, the jack rabbits

¹ Abnormal specimens are not unknown both of rabbits and hares in which the external ears are defective or absent, and there are two such examples of rabbits in the Museum of the Royal College of Surgeons, placed there by Tegetmeier, and for particulars of which I am indebted to Burne. See Milroy, *Field*, 9th January 1904, 51; Bird, *Field*, 30th January 1904, 139.

of North America and the arctic regions, and the varying hares of both continents. The other, which he styled *Caprolagus*, embraced all other forms. Later writers, however, such as Lyon, *Smithsonian Miscellaneous Collections*, xlv., 389, 15th June 1904, and Nelson, *N. Amer. Fauna*, No. 29, 31st August 1909, consider that Forsyth Major's group, *Caprolagus*, includes several genera not less clearly defined than *Lepus*. Only one of these, *Oryctolagus*, containing the rabbit, affects British naturalists.

Further subdivision of the large and unwieldy genus *Lepus* is inevitable, but has not hitherto been successfully effected. A commencement may be made with the Greenland Hare, *L. grønlandicus* of Rhoades, which is thoroughly differentiated from any other known form, and I propose to assign it to a new genus—*Boreolepus*—based specially on its protruding premaxillary region and large slightly curved upper incisors which stand out clear of the skull when viewed from above. These characters, together with the stout fossorial claws, heavy wool-like coat and permanent white (or whitish) colour, affecting both hair and underfur, form a combination denoting extreme specialisation to suit very unusual conditions—for the animal has to scratch and pull out its food from under snow (see Manniche, *Mammals of North-East Greenland*, 1910, 31)—and unapproached by any other known hare.

The Greenland Hare is a remarkable instance of adaptation to the intense arctic conditions in which it exists. Inhabiting the permanent snowfields of the north coast of Greenland and Ellesmere Land, on which it is the companion of the Northern Musk Ox, *Ovibos wardi*, it penetrates beyond 83° north latitude as far towards the Pole as terrestrial mammals can exist. In spite of the rigorous climate it is a large form, reaching a weight of 8 to 10 lbs. (Feilden). Although it produces only one set of young in the brief arctic summer, these are numerous enough to equal the combined product of two or three litters of some of the southern species, for Feilden (*Zoologist*, 1877, 354, and Appendix to Nares's *Voyage to the Polar Sea*, 1878, ii., 204) records seven to eight young; and Fabricius (*Fauna Grønlandica*, 1780, 25) eight.

There are four **British species** of *Leporidae*, the arrangement

of which in the present work and in Bell's *British Mammals* is shown below :—

<i>Bell's system of 1874 :—</i>		<i>System of present work :—</i>	
(1) LEPUS TIMIDUS	becomes	(2) LEPUS EUROPÆUS OCCIDENTALIS.	
(2) L. VARIABILIS	"	{ (3) L. TIMIDUS SCOTICUS.	
		{ (4) L. HIBERNICUS.	
(3) L. CUNICULUS	"	(1) ORYCTOLAGUS CUNICULUS.	

The numbers indicate the order in which the animals are arranged in the two works.

General characters of hares and rabbits:—The hares and rabbits are remarkable for their combination of primitive and specialised characters. Thus, although in the comparatively greater number of teeth their dental formula is very primitive as compared with that of other rodents, the individual cheek-teeth (to be described under genus *Lepus*) have undergone the most profound specialisation. The ears are very prominent and efficient, while the skeletons of the limbs resemble in certain respects those of the swift-footed ungulates. The form of the distal articulation of the humerus is similar to that of the horse, and in the more highly developed forms the ulna is reduced and the radius becomes longer than the humerus.

The hind feet are long, powerful, and efficient, and in rapid progression they are almost the sole propelling power, the action of the fore limbs being then merely accessory (see Tracks and spoor, below, p. 168). All four feet are thickly clothed with fur, so that the animals can pass with ease over snow or smooth slippery surfaces; hence the old Greek name *δασυπους* (dasypod) as used by Aristotle (*Historia Animalium*, ed. Thompson, 1910, iii., 12, 519^a, 23). They thus differ entirely in their construction from the corresponding members in fast carnivora, the weight of which is supported on a series of elastic pads; and from the ungulates, in which a development of the horny nails is called in for the same purpose. Probably the leporine type is the most successful of the three, since it avoids the wounding and soreness caused to bare padded feet, such as those of fast dogs, on very hard ground; but in many of the northern carnivores a compromise is effected by a considerable growth of hair between the pads. Animals with bare padded feet, such as foxhounds or greyhounds, cannot work in time of

frost, and on hard ground the hoofs of horses soon wear away if not shod, and their legs suffer from the jars of constant work; similarly, cattle become very footsore if driven far on roads. Under the same conditions the constantly renewable hairy covering of the leporine foot does not wear away with much usage, and it is superior to both pad and hoof as a lessener of shock to the leg as a whole, and as securing a grip on slippery or rocky ground. But on moderately soft, wet, or sticky ground the feet of carnivores and ungulates are superior, especially those with more than one toe, which can be spread out so as to prevent sinking in mud; while those of leporines may become clogged. The leporine foot may thus have had its origin in an animal frequenting rocks, hard plains, or snow.

The **fur** consists of three kinds of hairs—viz., (1) a short, thick, soft wool or underfur, which is mainly concealed by (2) an abundant set of strong hairs, generally annulated, which push through the underfur and overlie it. These are largely responsible for the external colouring of the animal, but their influence is modified by (3) a third set of hairs, also for the most part annulated, which are sparsely scattered over the body, and longer than either of the other kinds. These are present in their fullest abundance only in the adult, and their tips wear away when the coat becomes old. The fur as a whole is most abundant on the back, and least so, although longest, on the abdomen. Its denseness varies with the season and weather, being thickest in winter and thinnest in summer.

At the back of the neck and over the area covered by the ears the underfur alone is present in British species, and, having usually a distinctive coloration, forms a patch, which, if the ears be raised, shows up very conspicuously.

Nelson finds three **age-pelages** in American forms:—(1) a soft woolly *juvenal pelage*, which is comparable to the downy plumage of young birds, and which gives way when the animal is less than half-grown to (2) the *post-juvenal pelage*. In the latter, which is usually carried until the animal is nearly adult, the middle coat of hair is much more developed than in the *juvenal pelage*, but it is finer than in adults, and the long outer hairs are mostly lacking. These three pelages are undoubtedly present in the Scottish and Irish Hares, but their existence in

the Brown Hare and the Rabbit has not been demonstrated, and, even if present, they are certainly not conspicuous.

There are two annual **moult**s in all northern forms, and the colour-changes which accompany them may be more or less conspicuous according to the climate. Many forms are white in winter, but dusky or brown in summer, and the change of colour may affect both the hairs and the underfur, or only the hairs; others (including *Oryctolagus*) undergo only a partial whitening in winter. Southern forms do not whiten at all, and in some cases, as in the American subgenus *Macrotolagus*, which includes the Black-tailed Jack Rabbits of Mexico and the Western United States, there is only one moult, usually in late summer or autumn. Individuals of the same species may at different parts of their range exhibit all the different steps between complete winter whitening and the opposite condition; this being the case with *L. europæus*, and almost so with the American White-tailed Rabbit or Prairie Hare (*L. campestris*). A feature of the moulting period is the falling out of the old dead hairs in blocks so as to expose the underfur and temporarily alter the colour of the animal. Similarly, unexpected colour effects are produced by the wearing away of the black tips of the hairs and by bleaching, but the latter process is not conspicuous in British hares. In addition to the regular moults, many of the hairs may be cast and replaced at any season of the year.

The **colour** is evidently very plastic and liable to be influenced by climate; species inhabiting deserts are paler and greyer, while those of humid regions are darker and have the buff or rusty shades deeper and richer. The arctic hares of America are tricoloured, with the flanks darker than the back; but other American species have the sides lighter, and in the White-sided Jack Rabbits of the *Lepus callotis* group the conspicuous white flank-area can be shifted at will on to the back, so as to form a directive signal (Nelson, *op. cit.*, 25-26).

Age characters:—Hares and rabbits grow rapidly and breed at a very early age, even before they are fully grown. It is not easy to distinguish perfectly adult individuals, and inability to do so has led to many mistakes, although careful instructions on this point have been handed down for generations from old

writers.¹ Apart from the pelage, which will be described under each species, the young have usually been distinguished from the adults by a number of characters. The ears tear easily, the cleft of the lip is narrow, the claws are smooth, short, and sharp, the under-jaw breaks easily if the two divisions are pressed together at the posterior end, and the heads (epiphyses) of the bones of the "knees," which are really the wrists or carpal joints, of the fore legs, are not fused, so that the thumb-nail may be inserted between them. In old animals the ears are dry and tough, the cleft of the lips is spreading, the claws are long, blunt, and rugged, the under-jaw will not easily break, and the heads of the bones of the carpal joints are so close together as to leave no space between them large enough for insertion of the thumb-nail.

After a careful examination of the above points, I find the tearing of the ears the most useful test of complete maturity, and it is one that is in use amongst poulterers. The ears remain "tender" after the jaw has become sufficiently ossified to resist reasonable pressure. Dimensions are not very reliable, for the animals vary a good deal in different localities, and it must be remembered that the vast majority of hares and rabbits are immature, so that old individuals may almost be regarded as exceptional.

White spots on the forehead are rather frequent in all the British species, and are by some regarded as indicative of youth, by others of mature age (as by Drane in the case of the Brown Hare), and they actually appear to be characteristic both of the very young and very old. A fanciful notion that they are connected with the number of young in a litter does not appear to possess any real value.

In the skull the superciliary processes of the frontals probably afford the best means of distinguishing between young and old. These processes are at first slender and narrow, and their free ends enclose well-marked spaces. Later they grow broad and heavy and the tips may meet and fuse with

¹ "Men know by the outer side of the hare's leg if she is passed a year. And so men should know of a hound, of a fox, and of a wolf, by a little bone that they have in a bone which is next the sinews, where there is a little cavity." (*The Master of Game*, translated from the French of Gaston de Foix of about 1387, Baillie-Grohmann's ed. 1904, 12, writing probably of the pisiform bone and the tendon of the flexor carpi ulnaris.)

the skull so as to enclose foramina, or their inner borders may coalesce along their whole length. The growth is gradual, and forms no exact indication of the moment when the animal becomes adult. But it will be found that not only does the process grow towards the skull, but the spot at which it will fuse with the frontal bone prepares itself as it were by roughening and then forming a knob. The roughening of the future point of fusion for the posterior process will be found, as Miller informs me, to be a reliable indication of maturity.

Sex characters:—Males, sometimes even when quite small, have distinctly thicker and shorter heads than females, their ears often seem to the eye shorter and thicker, and, when of full size, torn from fighting. The head of the female, whether viewed from in front or from the side, is built on distinctly finer lines, so that the sex of an individual can usually be ascertained from a glance at the head.

The demeanour of a male, restless, excitable, quarrelsome, sniffing the ground, and never the leader of a party, frequently betrays his sex.

Weight:—In hares old females are often heavier than the heaviest males, but most observers find these relations reversed in the Rabbit, but in any species an emasculated male would no doubt reach a weight greater than that of any female; the average weight for a series of either sex is sometimes approximately equal, and might be absolutely so if the influence of a sometimes perpetual breeding-season could be discounted.

Distribution:—In contrast to bats, which decrease in number of species from the continent of Europe, westwards to Ireland, the British Islands, taken as a whole (but not any of the three kingdoms individually) are richer in species of *Leporidae* than any of the neighbouring countries of Europe. This is due to the possession by Ireland of a peculiar species in the Irish Hare, as well as to the fact that in Great Britain the ranges of the Brown and Blue Hares meet and overlap. The latter position is now repeated in Skandinavia, owing to the introduction by sportsmen of the Brown Hare, but it is not a natural condition elsewhere in western Europe.

Of the four British species, one only, the Rabbit, is found in all three kingdoms, but its presence is everywhere due to intro-

duction some time during the historical period. The Irish Hare is indigenous and peculiar to Ireland, and the Brown and Scottish Hares are found as sub-species closely allied to, but just distinguishable from, those of continental Europe. The **abundance** of all four depends largely on the treatment meted out to them by man. In many localities their numbers have undergone a considerable decrease. As against this, it is undoubtedly true that the Brown Hare shows a tendency to extension of range and increase of numbers in the wilder parts of Scotland, while the Scottish Hare, helped to a large extent by introduction, has spread southwards, and now thrives and multiplies on many mountains lying far to the south of its natural range. Irish hares have been freely introduced into Britain, and Brown and Blue into Ireland, and there are now localities where all three may be found on the same ground. Where not killed off by man, the numbers of hares and rabbits may become so great as to result in much inconvenience and loss to property.

Food:—These animals are about as purely vegetarian as any known mammals; the only exception known to me being that of rabbits eating snails. But their range of diet is, within its own limits, comparatively wide, and embraces all the digestible parts of plants, from the bark of young trees to roots, grain, berries, and tubers.

They do not **chew the cud**, as supposed by the ancient Hebrews, but, according to Drane, have the remarkable habit of passing most of their food twice through the body (see below, under Brown Hare). This observation is attributed by Bingley (p. 314) to Cartwright also (*Journal on the Coast of Labrador*, 1792) for tame rabbits, but the latter work is without an index, and I have been unable to find the reference.

They **drink** seldom, but this is no doubt because their food is frequently so wet that they must take in with it comparatively large quantities of water.

Droppings:—These are dry and of a characteristic round form, resembling somewhat those of goats and sheep, but differing in their size and in the, at all times, complete individuality of each pellet. When fresh they are sticky and dark in colour, but soon become lighter and drier, and show the nature of their contents, namely, the indigestible portions of herbage.

Habits:—The habits of hares and rabbits are very variable. Hares are solitary, or at least not sociable. Even if feeding together they separate if pursued, and trust to the secretions of their glands for again discovering each other. Rabbits are very sociable and live in large parties; they have no glands, since they do not normally stray far away from their burrows. Where food is abundant, few species wander much, but spend a life of peaceful monotony, feeding for the most part by night, and sleeping or playing in the hours of daylight. Those inhabiting mountains or cold districts may migrate to milder or more sheltered districts in winter; and more extensive movements have been reported and are, no doubt, due to exceptional circumstances, such as scarcity of food perhaps consequent on overgrowth of population.

The prey of all carnivorous animals and birds, the hares exhibit a rare combination of speed with staying powers, together with exceptional powers of dodging and out-manceuvring an enemy of superior pace. So secure are they, that the Brown Hare rarely seeks better shelter than a wood or thicket. Blue and Irish Hares more readily hide in holes, but no British hare constructs a permanent burrow. All of them will keep on running from an enemy until they die. But rabbits, although also possessed of considerable, although inferior speed, trust for safety to burrows, which they readily dig for themselves.

In accordance with the above differences of habit, the young at birth differ considerably. Those of the British hares being born above ground, without artificial nest of any kind, are fully formed miniatures of their parents; those of the rabbit, being dropped in the recesses of a (frequently special nesting) burrow, are at first naked, blind, and deaf; they repose on a warm bed made partly of their mother's own wool, and are at first safely blocked up in the burrow by her. The habits of some exotic species are intermediate in that, although the young are born above ground like those of our hares, they are placed in a nest like that of a rabbit.

The animals are polygamous, or rather promiscuous breeders. They generally produce several young at a birth, and the numbers of litters that may issue from a single female is limited

only by time, climate, and food supplies. The increase is, therefore, rapid. There seems to be some correlation between fertility and latitude; that is to say, northern forms produce fewer but large litters, whereas with southern forms the breeding season is almost perpetual.

Superfoetation has long been known and mentioned by many writers, including Herodotus (born B.C., 484; History, bk. iii., ch. cviii.), Aristotle (born B.C. 384; *Historia Animalium*, ed. Thompson, v., 9, 542^b, 33, 1910; Pliny,¹ and Sir Thomas Browne. The truth is, that in animals with a double uterus such phenomena are possible, but apparently of quite rare occurrence (see under the species), or they would be more frequently reported.

Voice:—Although usually supposed to be silent animals, the members of this family possess a comparatively varied vocabulary, the sounds in which they indulge varying from grunts to loud screams.

A remarkable **stamping of the hind feet** as an expression of excitement is characteristic of all British species, and probably of many exotic also, since it is practised by the American *L. americanus* (see below, under Scottish Hare).

Tracks and spoor:—These are very characteristic. When seen clearly, as on snow or mud, the pattern suggests a series of roughly formed, somewhat triangular figures, with more or less space between each. The sides are not filled in, but the positions of the angles are marked by the impressions of the four feet. Those of the two hind feet, which are long, mark the base of the triangle, while the two roughly spherical marks of the fore feet show the apex. When the animal is at rest the whole hind foot presses the ground so that the mark made is approximately the length of the foot. The fore feet then make contact either between the hind feet or only slightly in front of them, so that no triangle can then be traced, or it is very flat, and its apex points in the direction in which the animal is moving. When the animal begins to run, much lesser portions of the long hind feet touch the ground; but

¹ *Lepus omnium praede nascens, solus praeter dasypodem superfoetat, aliud educans, aliud in utero pilis vestitum, aliud implume, aliud inchoatum gerens pariter—Naturalis Historia*, viii., 55.

histories of very many others, which were formerly little known, have been fully elucidated, while, speaking generally, an immense increase in our knowledge on such important subjects as Migration, Distribution, Habits, Nidification, Plumages, has accrued: And lastly, a new and important branch of study has been instituted—namely, the recognition of the various Racial Forms or Sub-species exhibited by certain birds in the British Islands, on the Continent, and elsewhere.

A great advance has also been made towards a more satisfactory system of classification of the Aves—always a difficult subject—and this necessitates departures from the older views.

To bring this Standard Work thoroughly abreast of the most recent knowledge in all these departments is the object of the present work.

It should be remarked that while it is not intended to go fully into Synonymy, yet, where changes of nomenclature have been necessary in order to conform with the Law of Priority—the only method by which complete uniformity in nomenclature can ultimately be attained—the names used in the Fourth Edition of Yarrell's "British Birds" and in Saunders' "Manual," and the Trinomial Names of the British Racial Forms, and of those occurring in Britain as visitors from the Continent, will be quoted, as will also the Original Name under which the species was described.

In requesting Mr Eagle Clarke to undertake the duties of Editorship, the Publishers desire to make it known that they are acting under the advice of the late Mr Howard Saunders, who placed all his collected notes for a New Edition at Mr Eagle Clarke's disposal for this purpose. That Mr Eagle Clarke is eminently fitted for the work is well known to all who are interested in ornithological science. Through his investigations of the subject, and contributions to its literature, he has long been recognised as one of the foremost authorities on all that relates to British birds. He has studied our native birds in many portions of the British Islands, and has visited a number of bird-haunts in various parts of Europe in order to become acquainted in their Continental homes with the visitants that seek our shores.

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Member of the British Association Committee on the Migration of Birds as
Observed on the British and Irish Coasts, and Author of its Final
Reports, 1896-1903, etc.

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In 1884 Mr Eagle Clarke was elected a member of the British Association Committee on the Migration of Birds as observed on the British Coasts; and on the completion of that great enquiry, he was requested by his colleagues to prepare the final reports on the results obtained—a difficult and arduous task, which he accomplished in 1903.

During the preparation of these reports (five in number), Mr Eagle Clarke became much impressed with the advantages which were likely to accrue from placing a trained ornithologist at a number of the most favourably situated observing-stations around our coasts. If this could be done, he believed that some of the difficulties which the phenomena presented might be solved, and our knowledge regarding the subject generally considerably advanced.

This conviction led him to undertake, by the special permission of the Elder Brethren of the Trinity House and the Commissioners of Northern Lighthouses, a series of personal investigations at various light-stations, each of which was selected for a special purpose. In all, Mr Eagle Clarke has resided no fewer than forty-two weeks in these isolated and remote observatories; the stations visited being the Eddystone Lighthouse, the Kentish Knock Lightship (33 miles off the Essex coast), the lighthouses on the Flannan Isles and Suleskerry (both lying far out in the Atlantic), and the lighthouse at Fair Isle (the "British Heligoland"). He also visited the Island of Ushant—an important station—and Alderney for similar purposes; and spent a month or more in the autumn of 1910 at St Kilda, for the purpose of carrying the investigations to the outmost fringe of the British area.

With these unrivalled experiences for its foundations, the book should not only prove a valuable contribution to the subject of Bird-Migration, but should occupy a place essentially its own in ornithological literature.

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BY

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B.A. (CANTAB.), M.R.I.A., F.Z.S.

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BLACK AND WHITE, AND UPWARDS OF TWO HUNDRED AND
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1912

A NEW AND REVISED EDITION OF
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HISTORY OF BRITISH BIRDS

EDITED BY

WILLIAM EAGLE CLARKE, F.R.S.E., F.L.S.

Keeper of the Natural History Department, The Royal Scottish Museum; Member of the British Association Committee on the Migration of Birds as Observed on the British and Irish Coasts; Corresponding Fellow of the American Ornithologists' Union;
Correspondirender Mitglied des Ornithologischen Vereins in Wien;
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THE publication of Yarrell's "History of British Birds" was commenced in 1837 and completed in 1843. Its outstanding merits were at once recognised, and a Second Edition was called for in 1845, followed by a third in 1856.

From the issue of the Original Edition down to the present day, Yarrell's "History of British Birds" has generally and deservedly been regarded as the standard authority on British ornithology.

In the year 1871 a Fourth Edition was begun, under the masterly editorship of Professor Newton—the greatest British ornithologist of all time. Unfortunately Professor Newton's official engagements at the University of Cambridge only allowed him to complete the first two volumes; and in 1882 Mr Howard Saunders was selected to edit the remaining volumes, a task which he successfully accomplished to the entire satisfaction of ornithologists in 1885.

The many excellences of this last edition advanced the work more than ever in the public and in scientific favour. To its stimulating influence is to be mainly attributed the marvellous and unprecedented activity which has resulted in those extraordinary advances made in all branches of British ornithology during recent years—advances which have rendered it essential that a new work based upon this classical and comprehensive foundation should be issued.

During the period alluded to, a considerable number of new and interesting species have been added to our avifauna. The

CONTENTS OF PART X.

RODENTIA (Rodents)—

	PAGE
<i>Leporidae</i> (Hares and Rabbits)	169
Genus <i>Oryctolagus</i>	172
The Rabbit or Cony	176

The English local names have been revised in part by Mr W. W. Skeat, M.A. (assisted by Professor W. W. Skeat), and in part by Mr C. M. Drennan, M.A. Lond., late Scholar Emm. Coll. Camb.; the Celtic and Gaelic names by Dr E. S. Quiggin, M.A., Ph.D., Fellow and Lecturer in Modern Languages and Celtic of Gonville and Caius College, Cambridge; while a list of Scottish Gaelic names have been supplied by Mr C. H. Alston. Valuable assistance has been rendered by Mr M. C. A. Hinton regarding extinct Mammals.

ILLUSTRATIONS

FULL-PAGE (*Black and White*).

- Common Shrew—(1) Left Fore and (2) Left Hind Foot. Lesser Shrew—(3) Left Fore and (4) Left Hind Foot.
 Heads of (1) Male and (2) Female Rabbit, to show sexual differences. Side view.
 Heads of (1) Male and (2) Female Rabbit, to show sexual differences. Front view.
 Rabbits.

FIGURES IN TEXT.

- Diagram of Spoor of a Hare or Rabbit.
 Side view of Skull of *Oryctolagus cuniculus*.
 Diagram showing Interparietal Region of Skull in—(1) *Oryctolagus*; (2) *Lepus*.
 Magnified diagrammatic view of transverse section of anterior surface of a large Upper Incisor of (1) *Oryctolagus*, and (2) *Lepus*.
 Section of Simple Burrow in open Field.
 Section of Old Rabbit Burrow (C); enlarged by fox and badger (A).
 Plan of Complicated Burrow with five entrances.
 Plan (diagrammatic) of a Rabbit Burrow at Cappagh, Co. Waterford.
 Plan of a portion of a Second Burrow, partially excavated, at Cappagh, Co. Waterford.
 Section of Closed Stop or Nursery.
 Section of Closed Stop at side of Marsh Dyke.
 Section of Stop enlarged by a solitary Old Rabbit.

they are now thrown forward in advance of the shorter fore feet, and the triangle then points the other way. The space between the triangles increases with the pace, and the fore feet tend to be brought into a single straight line, thus removing or obliterating the triangles at extreme speed. Except on snow a perfect series is rarely seen, and usually the tracker must be content with the more or less imperfect impressions made by single feet at gateways or in other places where the ground is bare and soft. Such impressions are sometimes limited to the pricks of the claws, the disposition of which indicates whether the foot was a right or left, fore or hind. The size of the impressions is the only guide as to the species; the tracks of a rabbit are much smaller than those of any hare, and the print of the pads of the feet is less clear in the case of the lighter animal.

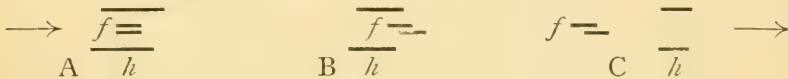


FIG. 31.—DIAGRAM OF SPOOR OF A HARE OR RABBIT.

A, sitting. B, moving slowly forwards. C, moving faster. *ff*, impressions of fore, and *hh* of hind feet. The arrows denote the direction in which the animal is moving. [The diagram is after one which appeared in the *Field* of 27th February 1904, 362, signed "R. C."]

It is evident that the part played by the fore legs in progression is comparatively unimportant. The main driving power comes from the powerful hind legs, and the short fore legs are merely accessory, their function being to give that continuity of action which is absent from a purely hopping or jumping animal. As stated above, the marks made by the fore feet tend to fall one in front of the other, but the hind legs remain approximately together. The animals, therefore, walk and trot with their fore, but leap only with their hind legs. Their movements only partially resemble those of the kangaroos, jerboas, and other hopping mammals; but in this connection it should be noted that Manniche (*op. cit. supra*, p. 160) describes the Greenland Hare as hurrying up a hill in rapid jumps, "moving on the tiptoes of the hind limbs, while the fore limbs either dangled in the air or were kept close to the breast."

Hares, and even more so rabbits, habitually travel over

the same ground in going to their feeding-places, so that the herbage over which they pass becomes worn down and a recognisable path or run is formed. The characteristic of these runs is their unevenness. The animals proceed by a series of leaps, and, if undisturbed, not only do they use particular tracks, but they generally make a leap of about the same length at the same place. The result is that the ground where they alight is worn bare, while the herbage has an opportunity of growing at the intermediate places which they leap over in their stride. It follows that the pace at which the animals are accustomed to travel at any one part of their runs can be calculated without difficulty by observation of the distance between the worn patches, and this knowledge is very extensively utilised by trappers and snarers.

Hares and rabbits all over the world seem to be subject to **epidemics**, the exact nature of which is not necessarily similar in different regions. In North America the various species seem to go through a regular routine. First they become excessively abundant, so that the numbers of *Lepus americanus* have been estimated by Thompson Seton (i., 640), at ten thousand to the square mile; then a fatal disease breaks out, and within two years or so they almost totally disappear from vast areas. During the continuance of an epidemic fertility decreases, and fewer young are born. But, as soon as it has worn itself out, there is a "periodic" increase, and females may produce as many as six, eight, or even ten at a birth (Nelson, *North Amer. Fauna*, No. 29, 1909, 23-24; see also Preble, *op. cit.*, No. 27). Similarly, in Britain, overstocking of ground usually leads to an outbreak of disease, which is for a time very fatal, but not of long duration.

As compared with some other British mammals, shrews for instance, the rabbits are very recuperative and **hardy** and do not succumb easily to injuries, such as the loss of a leg; but hares die readily from shot wounds, or if even slightly bruised on the loins, or if run hard.

When the food is succulent the **flesh**, although varying much in the different genera, is generally excellent eating, but it is of poor quality when, as in arctic regions, the animals subsist only on rough herbage or the bark of trees.

A KEY TO BRITISH LEPORIDÆ.

I. EXTERNAL CHARACTERS:—

- I. Ear when bent forwards reaches far beyond
tip of nose } *LEPUS europæus.*
- II. Ear when bent forwards reaches about to tip of nose:—
1. Hind foot about equal in length to
tail, including hairs } *ORYCTOLAGUS cuni-*
culus.
2. Hind foot much longer than tail,
including hairs (in young speci-
mens double)—
- A. General colour ochraceous or
tawny; hind foot to 165 mm. } *LEPUS hibernicus.*
- B. General colour deep brown or
smoky (in winter whitish);
hind foot to 155 mm. } *L. timidus scoticus.*

II. TEETH AND SKULLS:—

- I. Course of root of upper incisor not visible
externally; length of bony palate greater
than width of posterior nares, which are
narrow } *ORYCTOLAGUS cuni-*
culus.
- II. Course of root of upper incisor visible
externally; length of bony palate less
than width of posterior nares, which are
very wide } *LEPUS.*
1. Root of upper incisor not reaching
premaxillo-maxillary suture; dis-
tance between anterior edge of
zygoma and anterior termination
of external groove greater than
least depth of arch } *LEPUS europæus.*
2. Root of upper incisor passing pre-
maxillo-maxillary suture; dis-
tance between anterior edge of
zygoma and anterior termination
of external groove less than least
depth of arch—
- A. Skull larger — occipito-nasal
length to 95 (or more) mm. } *L. hibernicus.*
- B. Skull smaller — occipito-nasal
length to 90 mm. } *L. timidus scoticus.*

GENUS ORYCTOLAGUS.

1758. LEPUS, Carolus Linnæus, *Systema Naturæ*, x., 57; xii., 77, 1766 (part); based on *L. timidus* of Linnæus—type, see Thomas, *Proc. Zool. Soc.* (London), March 1911, 145—*L. cuniculus* of Linnæus from Europe, and two other species.
1790. CUNICULUS, F. A. A. Meyer, *Mag. für Thiergeschichte*, I., i., 52-53; see also Gloger, *Gemeinnütziges Hand- und Hilfsbuch der Naturgeschichte*, I., 104, 1842; Gray, *Ann. and Mag. Nat. Hist.*, September 1867, 224; based on *Lepus campestris* of Meyer=*L. cuniculus* of Linnæus, but preoccupied by CUNICULUS of Brisson, *Regnum Animale*, 1762, 13, a genus of *Dipodidæ*, and by CUNICULUS of Wagner, *Natürliches System der Amphibien*, 1830, 21, a genus of *Muridæ*.
1874. ORYCTOLAGUS, W. Lilljeborg, *Sveriges och Norges Rygggradsdjur*, i., 417; a subgenus of *Lepus*, replacing the preoccupied CUNICULUS, and based on *Lepus cuniculus* of Linnæus; Trouessart; Forsyth Major (part); Thomas, *Ann. and Mag. Nat. Hist.*, January 1903, 78-79 (genus); Lyon (genus); Nelson (genus).

The **synonymy** is simple.

Classification:—The generic separation of the hares and rabbits, although only recently accepted, is supported by such a long list of distinctive characters that a perusal of them will surely be the best argument in its favour.

The true rabbits, of which one wild species is known, are active terrestrial rodents, of almost exclusively vegetarian and predominantly graminivorous diet. They prefer a mixed country, where an alternation of open fields and woods affords them both food and shelter. They usually construct and inhabit burrows, and differ from the hares (see genus *Lepus*) in their plumper, more rounded body, shorter hind limbs, longer tail, simpler pelage not subject to marked seasonal changes, and in the white flesh, which resembles that of a common fowl. They are extremely prolific, and drop their blind and naked young underground. They do not usually wander far from their burrows, and are unprovided with "recognition glands." The structure of the forearm is primitive and not specially modified either for speed, as in the hares, or, as might have been expected, for digging—see Forsyth Major, *Trans. Linnean Soc.* (London) *Zool.*, Nov. 1899, 433, etc., published 1900. This accounts for the fact that rabbits sometimes dispense with burrows in hard soils.

The **mammæ** may be three or more pairs.¹

¹ Darwin, *Variation of Animals and Plants under Domestication*, 1868, i., 106, gives the number for the domestic variety known as the "Belgian hare" as six (*i.e.*, three pairs), and for other domestic forms as variable.



(1)



(3)



(2)



(4)

COMMON SHREW.—(1) LEFT FORE AND (2) LEFT HIND FOOT (magnified 4 times).
LESSER SHREW.—(3) LEFT FORE AND (4) LEFT HIND FOOT (magnified $4\frac{1}{2}$ times).

Rabbits are known from the upper **pliocene** of central France and Italy by *O. lacosti* (Pomel); and from pleistocene deposits of Britain and continental Europe. Hinton has recently examined some bones from the pliocene Forest Bed of Norfolk, which are probably to be referred to *O. lacosti*. His description will appear later.

This small but well-marked genus was formerly known only from the Iberian Peninsula, the Balearic Islands, and southern France; thence it has spread naturally, or by introduction, to the greater part of temperate Europe. It has, besides, been artificially introduced in many localities, especially islands, all over the world. The only recent wild species, the well-known *O. cuniculus*, is easily domesticated, and has given rise to many

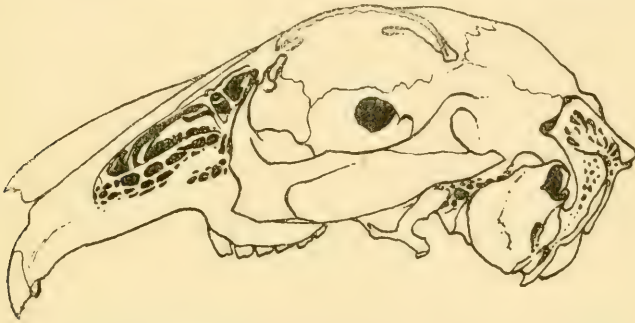


FIG. 32.—SIDE VIEW OF SKULL OF *Oryctolagus cuniculus* (life size).

distinct and stable artificial forms, all of which show the true generic characters, in some cases even more markedly than the parent stock.

Oryctolagus has no close relationships with Old-World genera. According to Lyon, it comes nearest in structure to the North American cottontails of the genus *Sylvilagus*, in which the young are also born blind and naked (Nelson, *North Amer. Fauna*, No. 29, 1909, 14); some species at least have the mammae as in *O. cuniculus* (Nelson, *in lit.*), the flesh is white (*fide* Nelson, and Preble, *in litt.*), and the sexes appear to be approximately equal in size (Nelson, *in lit.*). *Sylvilagus*, however, differs widely from *Oryctolagus* in skull characters, and does not habitually construct its own burrow (Nelson, *op. cit.*, 22); and in *S. floridanus* at least, inguinal glands are present, as in *Lepus*.

In the **skull** (as compared with *Lepus*) the superciliary processes of the frontals are slender, and not wide or distinctly triangular. In some specimens of domestic forms an anterior notch may become a foramen by junction of the anterior angle with the frontal bone; occasionally an anterior angle may be completely fused to the cranium, thus obliterating even a foramen (see also Figs. 44 and 45).

The interparietal bone is distinct throughout life.

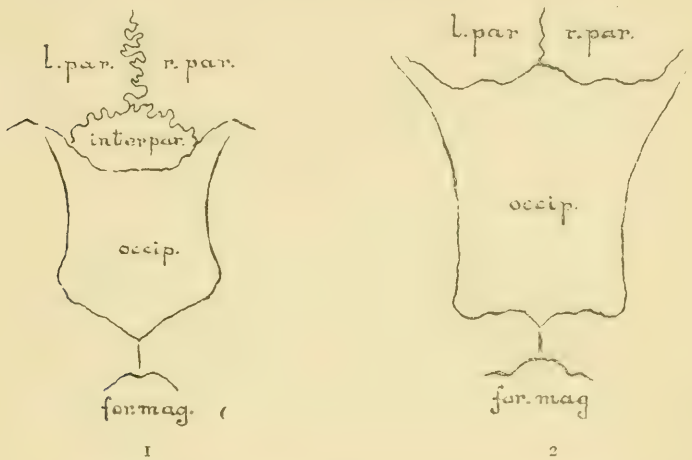


FIG. 33.—Diagram showing interparietal region of skull in—(1) *Oryctolagus*; (2) *Lepus*, in which the interparietal bone is absent in adults (both slightly magnified).

l. par. = left parietal; *r. par.* = right parietal; *occip.* = occipital; *for. mag.* = foramen magnum.

The bony palate is relatively long, its length being greater than the width either of the posterior nares or of the incisive foramina, both of which are narrow, especially the former. The parts of the palatine bones bordering the maxillæ below the posterior edge of the bony palate are better developed than in *Lepus*, and form part of the roof of the mouth along the posterior dental alveoli.

The anterior portions of the zygomata are deeper than the posterior. The foot-like extremities of the zygomatic processes of the squamosals are enlarged, so that the lateral length of a squamoso-malar suture is about one or one and a half times less than that of the superior border of its malar, measured from the anterior end of the squamoso-malar suture to the

antero-inferior angle of the orbit. The posterior free projecting extremities of the malars are large.

The mandible is characterized by the large size of the mental foramina, which are situated nearer to the cheek-teeth than in *Lepus*.

The **teeth** are as in *Lepus* (see below), but the longitudinal grooves of the large upper incisors are shallow, and never filled with cement. These teeth are more deeply implanted than in *Lepus europæus*, although less so than in the varying hares; the course of their roots can only with difficulty be seen externally.

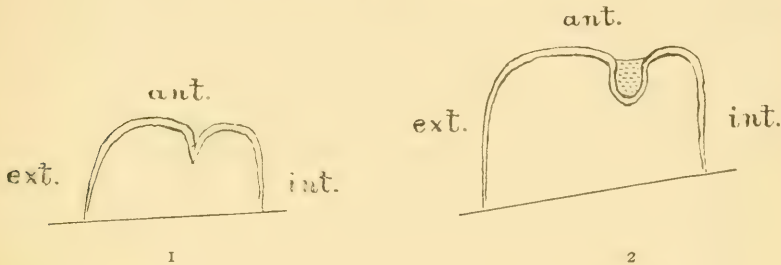


FIG. 34.—Magnified diagrammatic view of transverse section of anterior surface of a large upper incisor of (1) *Oryctolagus*, and (2) *Lepus*, to show the longitudinal groove and the cement with which it is usually filled in *Lepus*. Ant.=anterior; int.=interior; ext.=external.

In the **skeleton** the cervical vertebræ are uniformly shortened; the costal processes project comparatively far from their centra, and the anterior and posterior spines are less pronounced.

The lumbar vertebræ have transverse processes of the same relative length and width as in *Lepus*, but they do not rise abruptly from the anterior half of their centra; besides the anterior attachment, each has also a rather long posterior root following nearly the whole of the posterior half of the centrum, and sharply sloping into the process itself.

There are sixteen to seventeen caudal vertebræ.

The anterior ribs have the shafts only moderately enlarged ventrally.

The scapulæ are relatively narrow, with their superior borders straighter and less convex, the antero-superior angles relatively pronounced and not so gradually rounded as in *Lepus*, and the supra-spinous fossæ relatively narrow.

The ulnæ are very strong, and lie alongside the radii. The humeri are about equal in length to the forearms.

THE RABBIT OR CONY.

ORYCTOLAGUS CUNICULUS (Linnæus).

1666. CUNICULUS, a CONEY, Christopher Merrett, *Pinax*, 168.
1693. "CUNICULUS, Δασυπῆς, a Rabbit or Coney," John Ray, *Synopsis Methodica Animalium Quadrupedum*, etc., 205.
1758. LEPUS CUNICULUS, Carolus Linnæus, *Systema Naturæ*, x., 58; xii., 77, 1766; described from *Europa australi*, i.e., probably Europe south of Sweden; Berkenhout; Turton; Bingley; Fleming; Jenyns; MacGillivray; Keyserling and Blasius; Clermont; Flower and Lydekker; Lydekker; Millais.
1790. CUNICULUS CAMPESTRIS, F. A. A. Meyer, *Mag. für Thiergeschichte*, i., 1, 52-53, renaming *L. cuniculus* of Linnæus; not *Lepus campestris* of Bachman, 1837.
1820. LEPUS CANICULUS, E. Donovan, *Natural History of British Quadrupeds*, etc., plate xviii. (includes both tame and wild forms).
1837. LEPUS VERNICULARIS, William Thompson, *The Athenæum*, 468; named from Ireland, but without description, hence a *nomen nudum*.
1842. CUNICULUS DASYPUS, C. W. L. Gloger, *Gemeinnütziges Hand- und Hilssbuch der Naturgeschichte*, i., 104, renaming *L. cuniculus* of Linnæus.
1867. CUNICULUS FODIENS, J. E. Gray, *Ann. and Mag. Nat. Hist.*, September, 225, from Klein.
1874. ORYCTOLAGUS CUNICULUS, W. Lilljeborg, *Sveriges och Norges Ryggradsdjur*, i., 417 and 441; Trouessart; Forsyth Major; Thomas (1903); Johnston; Lyon; Nelson; Trouessart (1910).

Le Lapin of the French; *das Kaninchen* of the Germans.

Sex names:—Buck and doe.

The **synonymy** is that of the Wild Rabbit, a subject which, apart from the use of the term *Oryctolagus*, already treated under the heading of the genus, is usually considered to be quite simple. Thomas has, however, shown in *Proc. Zool. Soc.* (London), 1911, 145, that in the earlier editions of Linnæus's *Systema Naturæ* (as the 6th, 9, No. 2), the description of *Lepus cuniculus* was clearly based on an albino domestic rabbit with red eyes—*pupillis rubris*. Later on Linnæus became acquainted with the Wild Rabbit, and the words *pupillis rubris* no longer appear in his 10th edition. Instead, the sentence "Habitat in Europa australi," indicates that Linnæus, disregarding his original intention, now meant to indicate the Wild Rabbit, which is fortunate for posterity, as, if it had been necessary to regard the word *cuniculus* as applicable only to a domestic rabbit, a confusing change in nomenclature could hardly have been avoided. It is remarkable that, long before the era of nomenclatural troubles, Linnæus's meaning was discussed by Daines Barrington (*Phil. Trans. Roy. Soc.*, London, lxii., 1772).

The technical name or names of the domestic forms of rabbit are not of importance for present purposes. The name *nigripes* applied

by Bartlett to the "Himalayan" variety is, however, available (see below, p. 198).

Terminology :—There is no native name, either English or Celtic. The usual names "cony" and "rabbit" are, as will be shown below, both of French origin.

"Rabbit" is pronounced also *rabbidge* (*Dial. Dict.*), *rabbert* (North Devon), *rabbut* (Berkshire and Devon), and *rappit* (Cheshire and Lancashire). Earlier forms are *rabbette* (15th and 16th centuries), *rabet* (15th to 17th centuries), *rabbet* (16th to 18th centuries), as in Pennant, Bingley, Jenyns, and Donovan), *rabbatte* (16th century), *rabytt* (17th century), *rabit* (18th century). The source appears to be the Walloon form *rabet*, still in common use at Liège, from Middle Dutch *robbe*=a "rabet" with the suffix *ett* (Skeat). Ultimately of French origin, it is borrowed by Gaelic writers and spelt in various ways as *rabaid*, *rabbaid*, or *rabbait*. Although frequent in combinations, "rabbit" is a comparatively modern word, not known *fide* the *N. E. Dict.* to have been in use before 1398, when it occurs in a passage in Trevisa: "Conynges bringeth forthe many rabettes." But Skeat informs me that in Grose's *Antiquarian Repository*, 1807, i., 78, there is a list of things provided for a feast in the eleventh year of Richard II., *i.e.* in 1387-88. Along with the poultry consumed are mentioned "six kiddes" and "viiij dussen rabettes," and in the third course they had "rabetts rostad."

The above quotation indicates that "rabbit" was originally a diminutive applied to the young of the cony, itself an older word, as will be shown below. This fact is made clear from several sources. Thus in the *Promptorium Parvulorum*, written in 1440 (*Camden Soc. Public.*, t. ii, 1853, 421), a "rabet" is defined as a "yonge conye . . . *Cunicellus*." Again, in *The Boke of Nurture*, dating from about A.D. 1460, by John Russell (ed. Early Eng. Text Soc., 29), directions are given for carving the cony and also "rabettes," which are explained as "sowkers" (sucklers). In *The Boke of St Albans* (1486), the definition is further enlarged, and "a Bery (*i.e.*, burrow) of conyis" (*i.e.*, adults) is mentioned, as well as "A Nest of Rabettis" (*i.e.*, young); in fact, in the fifteenth century the two were so clearly distinguished as to form separate courses of the same feast (see below, p. 187). This use of the words had not died out in 1575, when we read that "The Conie . . . beareth hyr Rabettes xxx dayes, and then kindeleth" (*The Noble Arte of Venerie or Hunting*, 1575, ch. 63, 178).

"Cony" or "coney," various forms of which will be found in the *New English Dictionary*, is, as stated above, the older name, but is also comparatively modern. It occurs first in 1200, in the sense of the skin or fur of the animal (see *N. E. Dict.*); again in 1292 in the Anglo-Norman French of the lawyer Britton—"De veneyssoun et de pessoun et des conyis"; and ten years later (1302), in English—"We shule flo

the Conyng, ant make roste is loyne" (Political Songs in *Camden Soc. Public.*, 191), being a joke on the name of a Fleming called "Conyng." The word has not been traced farther back, though the animal was alluded to at earlier dates under the Latin name *cuniculus*; but there is no doubt that it originated in the old French *connil* or *counil* (a word cognate with the Provençal *conil*), of which the Norman plural was *coniz*, later *conis*; this gave an English plural, *conys*, *conies*, from which came a singular, *cony*, *conie*.

The forerunner of *cony*, the Greek *κύνικλος*, whence the Latin *cuniculus*, made its first appearance in literature in the "History" of Polybius (§ 12, 3, 10), written about 204 B.C. If Ælian (*De Natura Animalium*, xiii. 15), who lived in the third century of the Christian era, be correct, the word was imported from the Celto-Iberians, *i.e.*, the Basques. Strong (*Zoologist*, 1894, 401-6), would therefore connect it with the modern Basque word for a rabbit, *unchi*, which he suggests has probably undergone mutilation since Greeks and Romans borrowed it over two thousand years ago. But if so, the Romans must have soon forgotten the origin of the word, since Varro (*De Re Rustica*, iii., 12), and Pliny (*Historia Naturalis*, viii., 55) connected it with *cuneus* = a wedge, supposing it to have reference to the digging powers of the animal.

Many surnames and compound words are popularly connected with *cony*, but often in error. No genuine English name could have thus originated, because the first part would have to be a French word dating from about the 13th century. No name, therefore, derived from the word can be older than that period. On the other hand, many Irish names of places are genuinely thus derived, and must, therefore, be more recent than the Norman Conquest. They are usually easy to recognise, and may be found in Joyce's *Irish Names of Places*; but a few are difficult, such as *Kylenagonceny* (*Coill-na-gcoinnidhe*) = wood of rabbits, Co. Limerick; and *Lisnagunnion* = fort of rabbits, Co. Monaghan.

Cony-garth or *coney-garth*, a rabbit-warren, from late Middle English *conyngerthe*, came undoubtedly, according to Skeat, by misdivision from *connynge* + *erthe*, as if from *cony* + *earth*. *Conyger* or *conigree*; *coney-grees* or *coney-greys* (as in Cheshire, *fide* Coward and Oldham); *coneygreeves* (also in Cheshire); and *cunnigreeene*, with many other forms, being corruptions of the same type, came from the Old French *conniniere* or *coninyere* (adapted to *connin*), later also *conilliere*, from Low Latin *cunicularia*, being properly the feminine of an adjective *cunicularius* = pertaining to a rabbit (*Cent. Dict.*). All of these must be more recent than Domesday Book, which was finished about 1086, and in which warrens are not mentioned. "Cunicularia" first appear in the anonymous Latin book on English law cited as "Fleta,"

and supposed to have been written in 1290; and "conigers" in 1292, in Britton (see *N. E. Dict.*).

Many borrowed Celtic forms occur, as in Welsh *Cwning-gaer*, where the latter part of the word is adapted in form to *caer*=castle (*N. E. Dict.*). The Irish is *coinicéar*, occurring in many forms in all four provinces; the best known is *Cunnigar* or *Kinnegar*; the most corrupted are *Nicker* of Co. Limerick and *Nickeres* of Co. Tipperary (Joyce). As stated above, none of the above names are earlier than the Norman settlements (Westropp; Joyce, *in litt.*).

Riote or *ryote* is given by Harting (*The Rabbit*, 1898, 4) following Halliwell (*Dict. Arch. and Provincial Words*, 11th ed., 1889), as a third name for the animal, on the authority of a passage in "MS. Bodl. 546," one of the MSS. of *The Master of Game*, by Edward, second Duke of York (written 1406-1413). The passage has been modernised in Baillie-Grohman's edition of 1909, 74, from which I quote here in preference to the complete edition of 1904:¹—"Of conies I do not speak, for no man hunteth them unless it be bishhunters (fur hunters) and they hunt them with ferrets and with long, small hayes (*i.e.*, nets). Those raches (*i.e.*, scenting hounds) that run to a coney at any time ought to be rated saying to them loud, 'Ware riot, ware,' for no other wild beast in England is called riot save the coney only." There is, however, no evidence that the word *riot* was ever applied definitely to the rabbit as a name, and the Master of Game himself uses only the word *cony* elsewhere in his work (*ed. cit.* 18), so that some other explanation must be found for the word *riote*. The expression "ware riot" may mean merely "beware of brawling," in accordance with the usual signification of 'riot' as given by Skeat. This is borne out by the fact that the cries of hounds in pursuit of an unusual quarry are different from their ordinary 'music,' and may be noisier or more riotous; and no animal is more likely to lead hounds to 'run riot' than a rabbit.

Local names (non-Celtic):—*Bun* of Northumberland, Warwick, Worcester, Yorkshire, Scotland, and Ireland, also used for the tail of a hare or rabbit, as "Poor maukin . . . Cocks her bun in rude defiance of his pow'r" (Davidson, *Seasons*, 1798, 272, in *Dial. Dict.*); *bunny* (or *bonny* of Devon), a child's name in quite general use; *burrowing hare* of MacGillivray; *clergyman*, often applied to black varieties, as in Cheshire (the fur of black conies was worn by the clergy, see *N. E. Dict.*), compare *parson*, a term widely in use, as in Somerset and Devon (*Dial. Dict.*); *grazier*, *i.e.*, a young one just going to feed on grass, used both in England and Ireland (Coward and Oldham; *Dial. Dict.*; Joyce);

¹ The words are italicised by Baillie-Grohman, to signify that the matter was originally contributed by "Master of Game" himself, and not merely translated, like the greater part of the work, from the French of Gaston de Foix's *Livre de Chasse*.

hedgheg, a term applied to non-burrowing rabbits by dealers and fanciers (Blaine, *Encyclopædia of Rural Sports*, 1875, 883); *jack-rabbit*, a common name for a hare in North America, applied to half-grown specimens in North Lincolnshire (*Dial. Dict.*); *jack-sharp* of Lancashire (*Dial. Dict.*); *map* of Banff and Clydesdale (*Dial. Dict.*), which is also a name for a rabbit-call in Banff, Aberdeen, and Perth (*Dial. Dict.*); *mappy* (*Dial. Dict.*) of Northumberland, Galloway, Lothian, Fife, and Aberdeen, from the verb *map*=to nibble, compare *mupsie*=a young hare (*Dial. Dict.*); *parker*, a term apparently synonymous, or nearly so, with *hedgheg* (Blaine, *op. cit.*); *parson*, see *clergyman* above; *rump*, i.e., a young one, of Hereford (*Dial. Dict.*); *scut*, also written *scutt* in Nottingham and Sussex, and *skut* in Kent, West Yorkshire, Northumberland, and Lakeland, a common word for the tail of a hare or rabbit in Great Britain and Ireland, also occasionally applied to the animal itself, compare "Rabbits flashed here and there with little white scuts twinkling through the gorse" (Phillpotts, *Prophets*, 1897, 159, in *Dial. Dict.*); hence *scutty* means short-tailed, and "to show the white rabbit scut" is the same as to "show the white feather" (*Dial. Dict.*); *sweet-heart*, a tame rabbit (Blaine, *op. cit.*); *warrener*, a rabbit living in a warren (Blaine, *op. cit.*), cf. *parker*, above.

(Celtic):—There is no original name, but forms of *rabbit* or *cony* are used. Of the latter, the Irish version is *coinn*; the Scottish, *coinean* or *conning*; the Manx, *conning*; the Welsh, *cwning*, plural *cwninger*; the Cornish, *cynin*. Variants are numerous.

Hares and rabbits are said to *kindle* when they bring forth their young; compare:—

"As the cony that you see dwell where she is kindled."

—SHAKESPEARE, *As You Like It*, III., ii.

The word has several variants, as *kennel* of north country, *kinly* of West Somerset, *kinnle* of Durham and east and west Yorkshire, *kinle* of Durham (*Dial. Dict.*). It is also applied to cats, although this usage appears to be dying out; compare "A Kyndyll of yong Cattis" (*The Boke of St Albans*, 1486), and is evidently a word of some antiquity.

History:¹—The Rabbit was not known to the Greeks of classical times, although Xenophon's description, in his *Cynegeticus*, of a certain small species of hare has sometimes been interpreted as referring to it.

¹ The numerous references included in this section have been collected from a number of papers and works, all of which it would be impossible to mention. The following cannot be omitted:—(1) "The Rabbit (*Lepus cuniculus*) as known to the Ancients," by Houghton, *Ann. and Mag. Nat. Hist.*, March 1869, 279-183; (2) A long paper on the same subject by Brandt, *Bull. de l'Acad. Imp. des Sci. de St Petersburg*, ix. livre 4, 1875, 459-90; (3) *The Wanderings of Plants and Animals*, by Hehn, English ed. of Stallybrass, 1885, 343-45, 489-91; (4) *Gleanings from the Natural History of the Ancients*, by Watkins, 1896, 161-162; and (5) *Die Antike Tierwelt*, by Keller, 1909.

Aristotle (*Historia Animalium*, ed. Thompson, 1910, vi. 33, 580^a, 5) makes the curious statement concerning hares that "the young are born blind, as is the case with the greater part of the fissipedes or toed animals"; but there can be no doubt that this was an error and not an allusion to rabbits, the earliest known direct reference to which is that of Polybius, as quoted above (p. 178). Writing in Greek of Corsica in 204 B.C., he stated that, although there were no hares there, there were other animals which he called *κύνικλοι* (kunikloi), resembling small hares, but greatly different when examined in the hand, and burrowers in the ground. Some earlier allusions have not been substantiated. Thus Darwin (*Variation of Animals and Plants under Domestication*, 1868, I, 103) remarks that rabbits are mentioned in a translation of one of the books of the Chinese philosopher Confucius, who was born in 550 B.C. I have been unable to find the passage, but several authorities whom I have consulted are unanimous that it refers not to the Rabbit, but to some species of hare. De Mortillet also (*Promenade au Musée de Saint-Germain*, in *Matériaux pour l'Histoire de l'Homme*, Ann. 4, 1868, 10-12, 407) states that some caged rabbits ("Des lapins en cage") form part of an Egyptian bas-relief of the fifth dynasty. I have consulted Wallis Budge and others in regard to these, and there can be no doubt that the identification is due to confusion with hares.

Cuniculus next appears in the works of Roman writers of about the first century B.C. Posidonius of Apamæa, historian and philosopher of the beginning of that century, mentioned it in his *History* (as quoted by Athenæus, *Deipnosophistæ*, Bk. ix.); the poet Catullus (*Carmina*, xxxvii., 18) sang of Spain as a country full of rabbits and rabbit holes:—"Tu . . . cuniculosæ Celtiberiæ fili egnati;" and Martial (*Epigrammata*, xiii., 60) aptly described it in the lines "Gaudet in effossis habitare cuniculus antris." Varro (*op. cit. supra*, p. 178), who flourished between 116 and 27 B.C., states that it was found in Spain, and discusses the derivation of its name. The geographer Strabo (Bohn Library, I, 217), who was born about 63 B.C., notices (*Geographica*, Bk. iii., c. 2, § 6; Hamilton and Falconer's translation) its abundance in the Balearic Islands,¹ as well as in almost the whole of Iberia (Spain); it extended to Marseilles, "infesting likewise the islands" and destroying both seeds and trees, the latter by gnawing their roots. He states that the inhabitants of the Balearics once despatched an embassy to the

¹ Τῶν	δ' ὀλεθρίων	Θηρίων	σπάνις	πλὴν	τῶν	γεωρύχων
Of the	destructive	animals	a scarcity	except of the		earth-burrowing
λαγιδέων	[lagidēōn]	οὓς	ἐνιοι	λεβηρίδας	[lēbēridas]	προσαγορεύουσι.
little-hares		which	some	leberides		call-by-name.

According to Liddell and Scott's *Lexicon*, *λεβηρίς* may have been a Massiliote word² for "rabbit."

Romans to beg for a new land to dwell in, as they were quite driven out of their country by these animals, being no longer able to stand against the vast multitudes. Amongst the many methods of hunting these little hares was that by *γαλᾶς ἀγρίας* from Africa trained for the purpose, where the Greek words are usually translated "wild cats." The meaning of *γαλᾶς* is, however, uncertain; the passage looks like an early description of ferrets, but there is the difficulty that the Polecat or wild form of Ferret is unknown in Africa. Pliny (about A.D. 23-79) added that the deputation from the Balearic Islands was sent to the Emperor Augustus to demand a military force, apparently to assist in destroying the rabbits, and much the same story was repeated by Ælian (*op. cit. supra*, p. 178), the exact date of whose writings is uncertain.

The animal was evidently regarded by the Romans as peculiarly characteristic of Spain. It appears on Romano-Spanish coins of Hadrian (who was emperor from 117 to 138 A.D.), examples of which are in the British Museum; one is figured by Cohen, *Monnaies Frappées sous l'Empire Romain*, 2nd ed., vol. ii., 175, No. 821. There is also a marble group, again of the second century, in the British Museum (No. 1764), supposed to personify the Province of Spain, and which includes a boy, a woman, and a rabbit in a basket. This has been figured and described by Michelle Jatta, *Le Rappresentanze Figure Delle Provincie Romane*, 1908, fig. 10, 41.

The Jews also, who are said to have known of Spain and its products from the time of Solomon, are thought by some authorities to have given the country its modern name with reference to its rabbits. At least the classical name for the country, Hispania, now España or Spain, is traced back by Bochart to the Shemitic *tsâphân* = "the hider" (Smith's *Dict. of the Bible*, 1893, iii., 1364, art. Spain), a name which the Jews are believed to have applied to the rabbit in Spain. This word must have been originally used in connection with some other animal, almost certainly the "cony" of the Bible, which was not a rodent, but a "hyrax," or "rock badger" (*Procavia* of Storr, 1780, antedating *Hyrax* of Hermann, 1783), since true rabbits were unknown in Palestine. This fact makes Bochart's derivation extremely doubtful, but does not alter the fact that Spain was famous for its rabbits.

The older name for Spain, Tarshish = Tartessus of the Greeks, was used by Herodotus (*History*, iv., c. 192, B.C. 500, ed. Rawlinson, iii., 142)¹ in connection with the aforesaid word *γαλαῖ*, which has here been translated "weasels," and may again mean "ferrets," in which case this may represent the earliest indirect reference to rabbits, since ferrets

¹ Εἰσὶ	δὲ καὶ	γαλαῖ	ἐν	τῷ	σιλφίῳ	γινόμεναι	τῇσι
There are	also	weasels	in	the	Silphium	existing [found]	to-the
		Ταρτησσίησι		ὁμοίωταται.			
		Tarteesian		most-like.			

could only have been used for catching these rodents, and it is known that their use dates back to very early times.

It was not long before the value of rabbits for food so appealed to the Romans that they began to import them to Italy, where they appear to have gained a footing at least by A.D. 230, about which time they were observed numerously by Athenæus on an island (evidently Nisida or Nisita), near Dichæarchia or Puteoli, now Pozzuoli, itself near Naples (*Deipnosophistæ*, Bk. ix., c. 63, Yonge's translation in Bohn Library, ii., 631-632). In A.D. 303 the maximum prices for rabbits and hares were fixed by the edict of Diocletian at 40 and 150 denarii respectively. The former were considered a great delicacy, and in later times it was the fashion to eat the embryos, under the name of "laurices" ("laurex" being apparently a Balearic word signifying a foetal rabbit) during times of fast (see Gregory of Tours, quoted below).

From the above quotations it is certain that the Rabbit, as first known to history, was an abundant animal in the Iberian Peninsula, and that its range extended to the south of France as far as Marseilles, with Corsica and the Balearic Islands. Thence it was introduced to Italy before A.D. 230. That it was indigenous to the Iberian Peninsula is shown by many other facts, and it is not mentioned in early historical times as inhabiting any other region, but the following facts suggest that it may have also existed in central France, although without the knowledge of early writers.

Since there are no names for the animal in any central European language other than those derived from the Latin *cuniculus*, it cannot have been indigenous outside the above limits. But there is no information either as to exactly when or how it spread north from its original habitat; nor as to whether its coming was natural or artificial, and, if the latter, whether it was first introduced as a wild or tame animal. Reinach (*Antiquités Nationales—Description raisonnée du Musée de St Germain*, ii., 301) has reproduced some third-century drawings of rabbits from central and southern France; and Gregory of Tours (A.D. 540-594; see *Historiæ Francorum*, lib. v., iv.), writing of his contemporary Rocolenus, records the fact that in times of fasting he frequently ate unborn rabbits at or near Poitiers. On the other hand, Petrus Crescentius, an inhabitant of Bologna, Italy, about A.D. 1265-1321, who clearly defined the geographical distribution of the animal in his days, stating (*Opus ruralium Commodorum*, lib. ix., c. 80) that rabbits inhabited Spain, Provence, and the neighbouring parts of Lombardy, omitted all mention of central France. This is remarkable, since these rodents must also have been known at least as far north as central France before the thirteenth century; as apart from the fact that they had been already introduced into Britain (see below, p. 186), they are familiarly described in the northern or central French original of Chaucer's *Romaunt of the Rose* (see p. 196). The incon-

sistency might be explained if it could be shown that Gregory's rabbits as well as the first introductions to Britain, were of a tame or semi-tame stock, which later escaped and became wild. Rabbits must have been domesticated at a very early date, and, it might have been expected, by the Spaniards, and, following them, by the Romans; but it is noteworthy that domestic races are not mentioned by any of the earlier writers. It is clear from the German naturalist Gesner's account (1551) that, in the wild state at least, they were unknown in Switzerland and south Germany (Zurich, Basle, Strassburg) at that date. He is compelled to restrict himself to a description of their varieties in colour, and to note their abundance ("copiosissimi sunt") in hilly places and rocky mountains in Spain, which details he obtained by letter from a friend (p. 397); and he adds a note on their great numbers in England (p. 398), and comments on the fact that in that country some people lived entirely by keeping rabbits.

At about the same date they were so abundant in central France that du Fouilloux, who wrote *La Venerie* at Poitiers in 1561, declared that gentlemen would not spend much time in their pursuit, but left that amusement to their servants.

The animal is commonly supposed to have been introduced into **Britain** by the Romans, but this was certainly not the case, since, as shown above, it had no native name in any part of the three kingdoms until the Normans came over and named it. Another point of importance in this connection, and supporting a French as against a Roman introduction, is the fact that the British Rabbit belongs to the typical northern subspecies *O. cuniculus cuniculus*, and not to the smaller Mediterranean form. The first advocate of a Roman introduction appears to have been John Whitaker (*The History of Manchester*; London, 1771, I., x., 344), but he cites no facts in support of it, and he may have been misled by a supposed Latin origin of the name "cony," whereas, in fact, as has been shown above, this word, as well as the more modern term "rabbit," came to Britain from the French.

There are no pre-Norman British allusions to the animal, and it does not appear on coins as in Spain. Had it been known in Britain in his time, Julius Cæsar would no doubt have mentioned it with the hare, the hen, and the goose, all three of which he stated to have been foods unlawful to the ancient Britains (*De Bello Gallico*, v., 12). As noticed above, warrens are not named in Domesday Book, and could not, therefore, have been known in the eleventh century; and rabbits were also omitted by King John when, about May 1199, as Earl of Moreton (*i.e.*, Mortain in Normandy), he granted immunities to his tenants outside the regard of Dartmoor Forest, Devon, to take hares and other animals (see Rowe's *Perambulation of Dartmoor*, 1848, 263); and they do not appear in other documents of the period, although

specifying hares, pheasants, and partridges. The above quotations suggest absence, or at least scarcity. Between A.D. 1183-1186, however, "cuniculi" were casually named by Giraldus Cambrensis when writing in Latin of the Irish Hare (see below, under *Irish Hare*, where the whole passage is transcribed); and as shown above on p. 177, the fur or skin was mentioned in 1200 (and Sir James Murray informs me that the passage may well date from 1175). Both references indicate that rabbits were then well known, although not necessarily members of the British fauna. The first undoubted record of their occurrence in Britain has been supplied by Hinton (MS.), who has recently determined the bones of individuals used for food from the midden of Rayleigh Castle, Essex, the occupation of which commenced in the eleventh and ended about the beginning of the thirteenth century. That they must have become plentiful, at any rate locally, by, at latest, the second half of the latter century, is shown by an inquisition of Lundy Island made in 1274 (Steinman, *Collectanea Topographica*, iv., 1837, 316-17), wherein the annual taking is estimated at two thousand, being worth £5, 10s., and the estimate is said to be at 5s. 6d. "each hundred skins, because the flesh is not sold," although it was considered as of some value to the keepers of the island. In 1272 the capture of conies with ferrets at Waleton is mentioned (Rogers, *History of Agriculture and Prices in England*, ii., 576); and in 1282, at Rhuddlan Castle, Flint, Richard-le-Forester received 3s. 6d. for catching these animals for the king's use and for keeping the king's ferrets (*The Antiquary*, August 1911, 302). Subsequent allusions are more frequent; in 1290 rabbit-warrens (*cunicularia*) appear in Fleta (see above, p. 178), and the skins were priced at Oxford several times between 1310 and 1313 at rates varying from ten to the shilling to twenty-six for 1s. 11d. (Rogers, *op. cit.*, ii. 537). The animal soon became an important item at feasts, and in Henry's *History of Great Britain* (ed. 1., 1781, vol. iv., App. iii.), being a translation from *Historie Anglicane Scriptores*, by Gulielmus Thom. Cantuariensis, 1652 (*Chronica*, 2010), the following list of meat and poultry is recorded as having been paid for at the installation feast of Ralph de Borne, Abbot of St Austin's Abbey, Canterbury, in 1309:—

De porcis C. pretii	xvj. li.
De multonibus CC. pretii	xxx. li.
De aucis M. pretii	xvj. li.
De caponibus et gallinis D. pretii	vj. li. v. s.
De pulonibus iiij. C. lxxxj. pretii	lxxiiij. s.
De porcellis CC. pretii	C. s.
De Cignis xxxiiij. pretii	vij. li.
De cuniculis vj. C. pretii	xv. li.

Line 1=porkers; 2=wethers; 3=geese; 4=capons and fowls; 5=chickens; 6=apparently sucking pigs; 7=swans; 8=rabbits.

The rabbits, therefore, cost 6d. each, equal to about 6s. 6d. of our own time.

This price, which was identical with that of a porcellus (?=sucking pig) in the same list, presents a valuable indication of the scarcity of rabbits at the period, and suggests that they were still something out of the common. On the other hand, it seems to have been exceptionally high even for the time, for the maximum encountered by Rogers, who (*op. cit.*) made a special study of the question, was 5d. each in 1270, and thereafter, according to his researches, rabbits became cheaper until, in 1365,¹ they were entered in certain lists at 2½d. (*op. cit.*, i., 33 and 165), and in 1413-1414 at 2d. (*op. cit.*, iii., 130). Rogers considered (i., 340) that in the thirteenth and fourteenth centuries rabbits were so dear as to suggest, either that they were at that time confined to particular localities, from which they subsequently spread over the whole country (a view which seems to be countenanced by the fact that the value did not increase in the later part of the period); or, as seems hardly credible, that they were rigorously and effectually protected in the interests of the great landowners. Not only were the prices at first, relatively to those charged for other provisions, very high, but they afterwards declined, which is difficult to understand, "except on the hypothesis that rabbits were scarce, had been but lately introduced into the country, and were confined to very narrow limits or to particular properties" (p. 341).

Conies are often mentioned in the fourteenth century, as, for instance, by the poet Chaucer (1340-1400), "The litel conyes to hir playe gan hie" (*Assembly of Foules*, ed. Bell, iv., 1963); this line, however, as Skeat has most kindly informed me, was taken direct by Chaucer from an older French poem, *Roman de la Rose* (see below, p. 196), and must, therefore, be ruled out as evidence. In 1377 the animals were an article of commerce in Berwickshire (Tate, *Proc. Berwickshire Nat. Club*, 1863-1868, 441, 1869), and in 1389 conynges, with their warrens and connigries, and ferrets make their first appearance in the Statute Book (13 Richard II., stat. i., c. 13). But some records still suggest scarcity. At a banquet given to Richard II. by the Bishop of Durham in 1386 four hundred conies were served; but in a Determination Feast in 1395 twenty couples were bought at 6d. or 8d. the couple, which seem to have been procured from Bushey, Hertfordshire, whence they were carried to Oxford at a charge of ½d. each. This would hardly have been necessary had the animals not been scarce, and the fact supports Rogers's belief, as quoted above, that they were still unevenly distributed over the country, having been introduced before the thirteenth century.

In the early years of the fifteenth century the animals were mentioned

¹ In Boase's *Registrum Collegii Exoniensis*, 1894, xl., it is stated that in Lent 1361, at a feast of St Thomas the Martyr, 8d. was paid "for rabbits," but unfortunately no account is given of the number obtained for this sum.

casually by Edward, second Duke of York (1406-1413, see above, p. 179, under Terminology); and in many of the great feasts of the period, from the Coronation of Henry IV. in 1399, to the stalling of the Archbishop of Canterbury in 1443 (see *Harl. MSS.*, 279, written about A.D. 1430-1440; and 4016, about A.D. 1450), both "conyngges" and "rabetys" (or similar forms), have a place in the bill of fare. They were clearly distinguished, and often appear as separate courses of the same feast, and conies at least were evidently so important that a special expression was used for carving them, carvers being instructed to "Unlace that cony" (*Babees Book*, Early Eng. Text Soc., 265). By 1465 they may well have become as abundant as they are now, since no less than four thousand "conyes" appear on the bill of fare at the grand feast given at the installation of "George Nevill, Archbishop of York, and Chancelour of Englande" (Leland, *Collectanea*, vol. vi., 2, etc.). In 1486 rabbits and conies are mentioned in *The Boke of St Albans*.

In the first half of the sixteenth century, one dozen "rabbet ronners" were sold for 2s. (*Household Ord.*, 333), and in 1530 the price was 5d. a couple in Yorkshire (Clarke and Roebuck). It seems, however, to have risen again soon afterwards, in agreement with that of other commodities, being 4d. each in 1550 (Rogers, *op. cit.*, iii, 191); and Cocks has sent me an extract from the diary of his collateral ancestor, Thomas Cocks of Canterbury, dated 9th November 1610, "for a rabbett 9d." Before that date the fame of their numbers in this country must have been widespread, for Gesner (1551), describes their immense abundance (*copia ingens cuniculorum*) in the same paragraph as that in which he treats of Spanish rabbits; and he comments on the fact that, although restricted in Spain to hilly and rocky places, in England they delighted in woods and groves, in fact in open country.

Both rabbits and conies are more than once mentioned by Shakespeare, who died in 1616:—*E.g.*, "parsley to stuff a rabbit" (*Taming of the Shrew*, IV., iv.); "Like a rabbit on a spit" (*Love's Labour's Lost*, III., i.); and "earth-delving conies" (*Venus and Adonis*, but see also above, p. 180); and early in the seventeenth century they had attained a position of value and profit, as well expressed by Reyce in 1618 (*The Breviary of Suffolk*, ed. Hervey, 1902, 35):—"Of the harmlesse Conies, which do delight naturally to make their abroad here, . . . their great increase, with rich profit for all good house keepers, hath made every one of any reckoning to prepare fitt harbour for them, with great welcome and entertainment, from whence it proceeds that there are so many warrens here in every place, which do furnish the next marketts, and are carried to London with noe little reckoning, from whence it is that there is none who deeme their houses well seated, who have nott to the same belonging a comon wealth of Conies, neither can hee

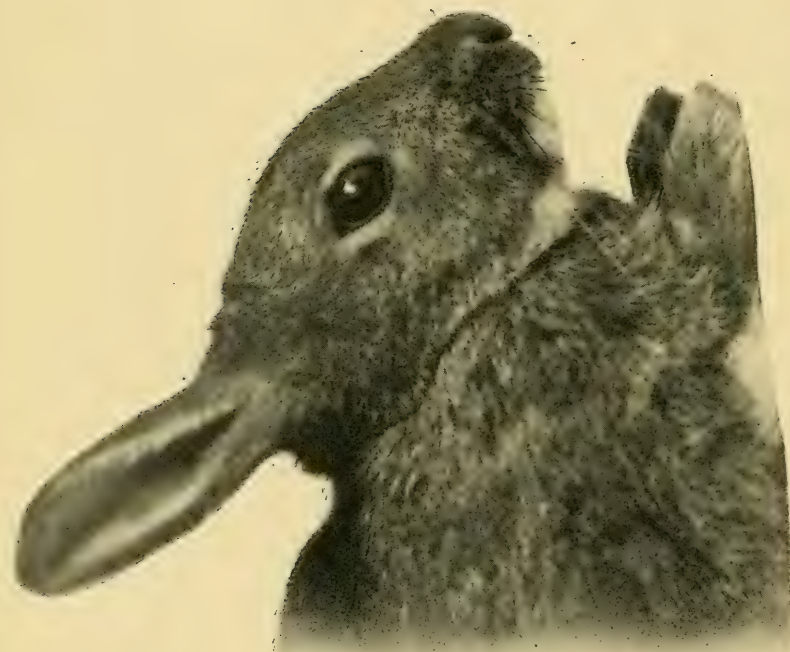
bee deemed a good house keeper that hath not plenty of these at all times to furnish his table."

There is no need to trace the animal's history further, since in its double capacity of provider of food and fur it remained in high value until recent years. At the end of the eighteenth century, Marshall (*Rural Economy of Yorkshire*, ed. 2, 1796, vol. ii., 226-228) calculated the value of the skin in proportion to that of the carcase as higher than that of a sheep or ox. But of recent years so many carcases and skins have been imported into Britain, especially from Australia, that the value has greatly declined, and it is doubtful if rabbits are any longer a source of profit to landowners, unless, perhaps, under somewhat exceptional circumstances and management.

The Rabbit, as shown by the passages quoted above on pages 179 and 184 from *The Master of Game* and from du Fouilloux, was never accounted of any honour or value by British or northern French sportsmen, nor was it deemed worthy of their attention until the days of fire-arms; and, as shown above (p. 187), it is only mentioned incidentally in *The Master of Game*. This is worth notice, because the great French sportsman, Gaston de Foix, of whose masterpiece, *Livre de Chasse* (commenced 1st May 1387), the English work by "Master of Game" is mainly a translation, admits it to a place in the list of fourteen animals, which he describes for the benefit of sportsmen.

In **Scotland**, according to Alston, the Rabbit was little known before the beginning of the nineteenth century, even in many lowland localities where it now abounds; up to that date it appears to have been confined mainly to certain islands and to the coastal sand-dunes of the mainland. But William Evans has shown that it was abundant in portions of the Edinburgh district at least as far back as the early part of the sixteenth century; and he suggests that it was introduced by the inmates of the various monasteries. Its numbers probably remained nearly stationary, or, more probably, its range was more or less restricted, until the early part of the nineteenth century, after which it began to occupy new country, and underwent a rapid increase in numbers. Similarly in Aberdeen, according to Sim, it is mentioned in documents as evidently common at least so far back as the year 1424; and the same authority states that in the *Exchequer Rolls* a duty of 1s. a hundred was charged on cony skins during the fourteenth century; but the latter record is not altogether trustworthy, as in enactments concerning duties items are sometimes copied from foreign documents.

There is evidence that in many other parts of Scotland, especially in the Highlands, the animal did not make its appearance until as the result of comparatively recent introductions; and in the north, as in Sutherland, many perish in severe winters (Harvie-Brown



(1)



(2)

HEADS OF (1) MALE AND (2) FEMALE RABBIT, to show sexual differences. Photographed by G. D. Croker, Waterford, from specimens obtained at Kilmanock, Co. Wexford, and arranged by M. Parle, gamekeeper.

and Buckley). In Caithness it is said to have been plentiful in 1793, but unknown in 1743 (Bruce). Of late years it has spread widely, until it is now as abundant and ubiquitous in Scotland, excepting only the highest hill-tops and the wet flow-lands, as in any other part of the three kingdoms.

The history of the Rabbit in **Ireland** is similar to that for Great Britain. The word "lepusculos" occurs in a list of Irish animals given by the ecclesiastic Augustin, who wrote about A.D. 655 (*Proc. Roy. Irish Acad.*, vii., 518, 1862), but this must evidently be interpreted as referring to the Irish Hare. Conies are found in a longer list contained in the Irish poem printed by Wilde (*Proc. cit.*, 188-189)—"Da choinin a Dhúmha duinn," *i.e.*, two conies from Dumho Duinn—but this poem, although supposed by Ball (*Proc. cit.*, ii., 541) to be older than A.D. 1000, really dates only, as Kuno Meyer informs me, from about the thirteenth or fourteenth century. The ancient Irish, who were great hunters, and wrote at length of the various beasts of chase, including hares, never mention rabbits, as it is certain they would have done had they known them. The oldest undoubted British reference to them of which I am aware is that of Giraldus Cambrensis, who, as stated above (p. 185), casually alluded to "cuniculi" in 1183-1186, but without definitely including them in the Irish Fauna. The animal's name begins to appear in documents at about the same time as in England, so that the conclusion is that its introduction to Ireland also must be attributed to the Normans. With their warrens, conies are casually noticed in the time of Edward I., viz., between 1274 and 1307 (see Westropp, *Proc. cit.*, xxv., c., 8th March 1905, 343); and in 1282 twenty skins from Balisax (now Ballysax), Co. Kildare, were priced at 1s. 4d. (Rogers, *op. cit.*, ii., 567); and one hundred "great coneyes" from the same locality in 1287 at 13s. 4d. (*id.*, ii., 558-559). In 1324 the profits of hunting the "cunicularium" at Rosslare, Co. Wexford, formed a portion of the return of the lands of Aymer de Valence, an item of information for which I am indebted to G. H. Orpen. In the fourteenth and fifteenth centuries the skins had become a regular article of export with those of other mammals, being included in *The Libel of English Policy* (Political Poems and Songs; Rolls Series, ii., 186), written about 1430: "Felles of kydde and conies grete plenté." Many later travellers in Ireland record having seen the animals in different parts of the country, as a matter of course. Fynes Moryson, in his "Description of Ireland," about 1600 (Falkiner's reprint, in *Illustrations of Irish History and Topography*, 1904, 223), wrote of "great plenty of . . . conies"; Sir William Brereton saw them on the banks of the river Slaney in the manor of Ollort (now Oulart), Ferns, Co. Wexford, on 16th July 1635 (Falkiner, *op. cit.*, 390); and for another notice of them, see below, p. 196. At the Park, near Wexford, on a Mr Hardy's land, rented from William

Synode (now Synot), the last writer noticed "abundance of rabbits, whereof here there are too many, so as they pester the ground." Later, Arthur Young, whose well-known "Tour in Ireland" took place during the years 1776-1779, noted the price of them in many parts of the country.

Distribution :—For the present distribution of the Rabbit, see that of its genus (above, p. 173). It has, however, been artificially introduced by man into so many localities all over the world that it is difficult to exactly define the boundaries of the areas where it is indigenous. In many cases it multiplies so exceedingly after introduction that, as in Australia, it has become a national plague. It will not, however, thrive in the Arctic regions, nor in the north of Europe generally, not even in the south of Norway, probably in consequence of the depth of snow that covers the ground in winter. Thus, as Winge informs me, although sometimes introduced, it has never become established in Denmark, and the exact degree of north latitude at which it will exist naturally in continental Europe has not been defined. It may, however, be successfully introduced on islands, in regions where it could not be established on the adjacent mainland, and this is characteristic of it everywhere throughout its range.

It is abundant in the Azores, Madeira, and the Salvage Islands, the last of which lie between the Canaries and Madeira, and has often been considered indigenous. But, since there is evidence that the early Portuguese navigators carried live rabbits on board ship, and that they turned them down at Porto Santo, a small island near Madeira, in 1418 or 1419 (see Darwin, *Variation of Animals and Plants under Domestication*, 1868, i., 112), it is probable that the stock on the other islands had a similar origin. Darwin was surprised to find that the Porto Santo rabbits possessed characters sufficient, had he not believed them to have originated since 1420, to "have ranked them as a distinct species." But this is explained by the fact that they belong to the small southern subspecies, *O. c. huxleyi* (Haeckel).

It is certainly not indigenous to Africa. Lataste did not meet with it on the mainland of Tunis, but found it abundant on islands off the coast; he also reported it as absent from the south of Algeria and the Sahara. Cabrera has obligingly informed me that in his opinion it is not a native of Morocco. It has been observed neither in the Riff, nor on the coast about Mogador and southwards, nor in the country between Mogador and Marrakesh. Although it certainly exists in the Chafarina Islands, it owes its presence there to introduction by the Spaniards.

Whatever be the origin of the **British** stock of rabbits, they are now probably the most vigorous, prolific, and abundant mammal in the islands, exclusive of the Brown Rat, the (true) mice, and the Common

Shrew. And this statement must not be taken to imply any inferiority. When the greater size of the Rabbit and its absolute defencelessness are taken into consideration, it is probable that it is, at least relatively speaking, more successful. Seven thousand have been killed by a single party in the course of one day's shooting (Millais). Simpson (*op. cit. infra*), a prominent breeder of wild ones, has put the number that can, given skilful management, be carried continuously on an acre of land as about one hundred; and a single London furrier is said to have accumulated ten tons weight of the tails alone in a single season (Patterson, *Eastern Norfolk*, 318). On this account it well deserves the title given to it by Poland, as "the great fur-producing animal of the kingdom," and foreigners travelling through Britain notice its abundance as one of the characteristic features of the fauna, a feature which appears to have been already evident in the sixteenth century (see Gesner's remarks quoted above on pp. 184 and 187).

The **fur** is used chiefly for felting, or hats; and is also dyed or clipped, and sold in imitation of the pelts of other more valuable animals, such as fur seal. Its cheapness makes its use almost universal, but it has little durability (see Poland, 278-289).

Although it thrives best on dry but rich pastures, the Rabbit may be expected wherever a blade of grass can grow; and from Cornwall to Caithness it holds its own in the face of the most relentless persecution, at the hands not only of man but of all stronger animals. It plants its colonies on almost inaccessible turfey ledges on the sides of sea cliffs and precipices. It ekes out a living even on poor lands; and soon reduces them to such a condition that larger grazing beasts would starve. Then, when overcrowding results in an epidemic, it dies away to scarcity, but a remnant is always left to reappear with renewed vigour and fertility until the former abundance is regained. If it objects to anything it is to cold and wet, but the objection is only relative, since it abounds in the continuous heavy rains of the Mull winters, and its mortality in that island is said to be far less than that of sheep (Simpson, *The Wild Rabbit in a New Aspect*, 1908, 22-23). Although checked by hard weather and heavy snowfalls, a few ascend to the cairns on the summits of the highest mountains even of Scotland; and in summer numbers thrive mightily on low-lying marshes, salt or fresh, entirely reckless of the disaster which usually overtakes them in winter. It loves cultivated fields and sheltered woodlands, where it grows fat and heavy on luxurious diet. But, albeit leaner and lighter in such a situation, it finds the barren windswept sand-dunes, perhaps because of their good drainage, a satisfactory habitat; and manages to maintain a thick population on some tiny stack or islet, where it contends with puffins and shearwaters for the possession of the burrows.

There is hardly an islet on which it is not established, having been

in all cases where information is available, introduced. So universally is this the case that it seems hardly necessary to give details. It is present, generally in abundance, in the Farn and Holy Islands, the Channel Islands, Wight, Lundy, Bardsey, Anglesey, the Skerries near Holyhead (Pennant), Man (plentiful from at least 1658, Kermodé); in probably all the Clyde islands, as Ailsa Craig, Little Cumbrae (at least from 1453), Great Cumbrae (previous to 1612, Boyd Watt), Arran (Pennant, Alston), Bute (W. Evans, *in lit.*), and other smaller islands (Boyd Watt); the Inner Hebrides, as Islay (Harvie-Brown and Buckley), Jura, Colonsay (Pennant, Alston), Iona (Harvie-Brown and Buckley), Mull (Alston), Tiree (Harvie-Brown and Buckley), Coll (Millais), Canna (Millais), and Skye (Macpherson); Handa and Rabbit Island (Kyle of Tongue), Sutherland (Harvie-Brown and Buckley); as well as the east coast islands in the Firth of Forth, including the Isle of May (W. Evans), and the Bass Rock (Millais). Although absent from St Kilda, it has been introduced into many of the Outer Hebrides, in particular Barra, Vatersay, South Uist, North Uist, Harris and Lewis (Harvie-Brown and Buckley). It was at an early date introduced in the Orkneys, and soon became so numerous that 36,000 skins were said to have been exported in 1795 (Alston). It is found on Fair Island (Kinnear).

According to Buckley and Evans, rabbits were plentiful in Shetland in 1750, and their occurrence there had been recorded so far back as 1700. They are now found more or less numerously throughout most of the larger islands from Unst to Dunrossness, but the above-named authors know of only one warren, that of Quendale, where the animals are really abundant. They are found on Fetlar, have been exterminated on Oxna, in Scalloway Bay, but are plentiful in Foula.

They are absent from the Faroes, or were so at the time of Feilden's last visit about 1890.

Many of the small islets off Ireland harbour colonies of rabbits. There may be mentioned Inistrahull, Co. Donegal (*Irish Naturalist*, 1897, 68); Lambay, Co. Dublin, where they were noticed by Rutty (*Nat. Hist. Co. of Dublin*, 1772, 274), and were so abundant in 1907 that 24,000 were killed in two years (Baring, *Irish Naturalist*, 1907, 22); the Saltees and Keeraghs, Co. Wexford (Barrett-Hamilton, *Irish Naturalist*, 1894, 68); the North Blasket, Western Island and Inishnabro, Co. Kerry (Andrews, *Dublin Nat. Hist. Review*, ii., 1855, 94). The ancient fort of Dun Ængus in Arran is practically a great warren (*vide* H. H. Brindley, 1888); and the animals are found also on Inishbofin; Inishturk; Caher (Browne, *Proc. Roy. Irish Acad.*, December 1898); and Clare Islands, in the latter case having been recently introduced (Westropp, *Proc. cit.*, "Clare Island Survey," December 1911, pt. 2, 34). A complete list is a desideratum.

Distribution in time:—Bones identified by their finders as those of the Rabbit, have been found in numbers of caves and in other deposits, chiefly in Great Britain, but also in Ireland. In most cases the remains were associated with others belonging to undoubtedly pleistocene species, but the Rabbit being a burrowing animal, fond of investigating cemeteries, its bones are usually open to the strong suspicion of being of recent origin, especially as their appearance is frequently fresh. This is the case with the bones found at Ightham and Longcliffe. Those found in the Kesh caves of Co. Sligo are certainly recent (Scharff, *Trans. Roy. Irish Acad.*, xxxii., B., iv., 200, September 1903), and are absent from the earlier strata. In a few instances, however, as at Kent's Cavern, the remains appear to be in the same state of preservation as those of undoubtedly early pleistocene mammals (Sanford, *Quart. Journ. Geol. Soc.*, London, xxvi., 1870, 138), and have been accepted as their contemporaries. Nine also of those found in the late pleistocene caves of Co. Clare are stated to have presented unmistakable signs of "antiquity" (Scharff, *Trans. cit.*, xxxiii., B., I, 39, February 1906), and to have belonged to an animal having shorter fore-limbs than the modern Rabbit. But it is so difficult to tell the antiquity or age of individuals of this burrowing rodent, that it were well to regard with suspicion results based solely on appearance or length of bones. It may, however, be regarded as certain that a rabbit, closely resembling and not hitherto distinguished from *O. cuniculus*, was a member of the Early English pleistocene fauna; it was also present in that of central and western continental Europe, where it is traceable back to an ancestor, *Lepus lacosti* of Pomel (*Catalogue Méthodique*, 1853, 44) in the upper pliocene of France. It died out, and became, as shown above, restricted to a quite small tract in south-western Europe, and did not again appear in its pleistocene haunts until a comparatively recent date. The above view was formed by Rolleston (*Sci. Papers and Addresses*, i., 335-336). Since then Forsyth Major, while preparing his still unpublished catalogue of fossil rodents in the British Museum, and more recently Hinton also (*in lit.*), have arrived at the same conclusion.

The disappearance of the Rabbit is believed to have been caused by the cold (which means, probably, the snow) of the Glacial Period. Its return to Britain must undoubtedly have been due to introduction by man, but it is possible, since present conditions are so favourable to its existence, that it made its way north to portions of central Europe unaided. The increase of its numbers and extension of its geographical range may have been due to the spread of tillage and the reduction of wild forested districts, helped by the destruction of carnivorous beasts and birds. These factors, especially the latter, must certainly have accounted in no inconsiderable measure for its recent increase in Scotland. A northern extension of the range of the cottontails of

North America has taken place under somewhat similar conditions (Nelson, *North Amer. Fauna*, No. 29, 1909, 21).

In the present state of knowledge, the ultimate **origin** of the Rabbit is lost in obscurity. All that can be said is that its nearest modern relatives appear to be the cottontails¹ of North and South America; but these, as shown above on p. 173, present a puzzling mixture of characters which are difficult to interpret. If the resemblance be not, as in the case of the water-shrews of Europe and North America,² merely due to convergence, then the Siwálik deposits of India may be looked to for light by furnishing an extinct connecting link between these two genera of the family inhabiting the Old and New Worlds. At present such light is not forthcoming, since only one bone of a hare or rabbit is known from these deposits, and that one, as Lydekker informs me, is too fragmentary for satisfactory determination of its affinities. For an African origin of the Rabbit, there is no evidence, which fact seems to rule out a third suggestion, somewhat tentatively advanced by Scharff, namely, that the original connection between the Rabbit and the cottontails was by some now submerged southern or equatorial continent bridging the Atlantic.³ The subject is discussed in connection with other mammals in the general Introduction.

Droppings:—These are of the typical leporine type, as described above on page 166. Their comparatively small diameter, measuring only about 9 to 11 mm., distinguishes them from those of the hares, in which the diameter reaches about 16 to 19 mm., as well as from those of goats, which are larger and not circular; the latter, when fresh, are usually attached to each other in a kind of string. Those of sheep, although also larger, are somewhat similar, but are very dark in colour, and do not show traces of herbage when dry. Rabbit droppings are often deposited in a conspicuous manner on bare spaces such as the surfaces of tree-stumps, or even on dry cow-dung. Their quantity at any one spot is, of course, much less than in the case of larger animals, such as sheep and goats, having droppings of similar character.

Description:—The general form and appearance, the skull and teeth, of the Wild Rabbit are typical of its genus. It resembles a small greyish hare, with shorter limbs, and longer recurved tail, carried lying close along the back. The ears,⁴ when bent forward, do not reach to

¹ Genus *Sylvilagus* of Gray.

² Subgenus *Neosorex*; see above, p. 127.

³ *The History of the European Fauna*, 1899, 291: "Its nearest living relatives, as we should almost expect, are found in South America."

⁴ Abnormal specimens are known wherein the ears are apparently absent; the deformity may be of various degrees, from those lacking pinnæ, but possessing external apertures, to those in which there is no opening to the exterior (see *Catal. Coll. Roy. College Surgeons*).

the tip of the nose, and thus differ markedly from those of the Brown Hare, but are relatively as long as in the varying hares.

The arrangement of the **fur**, which is very soft, especially on the head, resembles that of the hares (see above, p. 152). In healthy animals in good coat, the underfur does not take part in contributing to the general colour, being completely covered by the thick coat of long middle hairs. The extra long dusky hairs are comparatively scarce.

The general **colour** of the upper surface is a grizzled mixture of dusky and buffish tints, slightly darker in some individuals (particularly males), especially near the centre of the back. The nape is clothed with deep "ochraceous buff" underfur, without longer hairs. The limbs are, as a rule, ruddier than the back, but the rump is frequently greyer, especially in winter. The colour passes with moderate abruptness into the white of the inner surface of the limbs and of the under side, which white is interrupted only by a grizzled band passing across the lower throat and chest, and by another across the inguinal region. The ears are slightly rimmed with black posteriorly; they are variably furred, according to season, on the anterior outer side to about the point where they are longitudinally folded; on the remainder of the outer surface, and on the inner margins, they are clothed with fine, short fur, but the median interior surface is hairless. The upper side of the tail is black, slightly grizzled; its lower side is white. The soles of the feet are dirty yellowish or whitish.

Examined closely, the hairs of the underfur of the back are dusky, with the tips near "russet"; on the belly they are white with dusky bases, passing from one type to the other by insensible gradations. The annulated hairs on the back are dusky with a light base, and a subterminal band of light buff; the dusky band next to the base is usually the broadest, and that forming the tip the narrowest. Many intermediate gradations occur between the ringed hairs of the back and the white hairs of the belly. According to Hurst (*Linnean Soc.'s Journ. Zool.*, xxix., 1905, 299, etc.), there are in the hairs two, possibly three pigments, viz., yellow and black certainly, and also, probably, brown or chocolate, the latter apparently in close association with the black.

The winter fur is much thicker, especially on the rump, than that of summer; and the white area of the under side spreads upwards to a distinct, but variable, extent on the rump and hind legs. The flanks, cheeks, and regions surrounding the eyes may also be grey. The whitening seems to be accentuated in Orkney, where specimens inhabiting the hills are said to be "hoary in winter" (Barry, *History of the Orkney Islands*, 1805, 316).

An important **moult** takes place in autumn. This may be observed in individuals in Co. Wexford early in September, but is probably not general until the first frosts, after which rabbits are in heavier and

thicker coat, so that their skins are more valuable. In December and January the fur is in fine condition, and I suspect that it undergoes a gradual change throughout the winter. The new hairs, when first appearing, are very similar to those of the old coat, and not conspicuously different, as in the Brown Hare. There is also a spring moult as in the hares; it may not be completed until 7th July (specimen examined at Kilmanock, Co. Wexford), but I have noticed it also on 25th May.

The **young**, by the time they leave the nest, are, except in size, very similar to the adults, but the underfur being more prominent, the hairs less so, they have a woolly appearance. They are usually without the extra long hairs until about the age of two months (Hurst, *op. cit.*, 300), between which time and the third the juvenal coat is shed (Harting, *The Rabbit*, 8, footnote). I have examined one in process of moulting on 13th January 1911. White hairs, sometimes forming a definite patch or spot, are frequently found on the forehead.

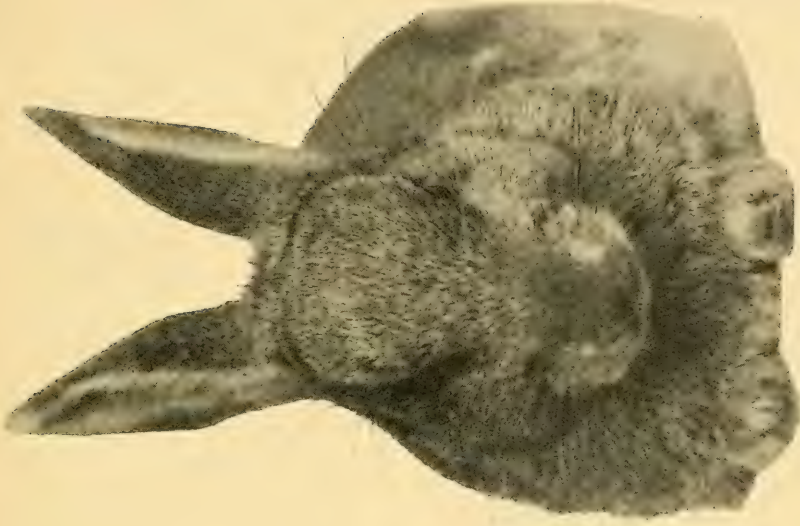
There are six **mammæ** arranged in three pairs, a pair pectoral and two pairs abdominal. [Note, however, that Darwin, *Variation of Animals and Plants under Domestication*, 1868, i., 106, writes: "The common wild rabbit always has ten mammæ."]

For **age and sex characters**, see above, under *Leporidae* (pp. 163-165). The blunt heads of the bucks (see Plates XII. and XIII.) are usually unmistakable as compared with the long lean heads of the does. Although widely known, I do not find this fact recorded except in Blaine's *Encyclopædia of Rural Sports*, new ed., 1875, 510.

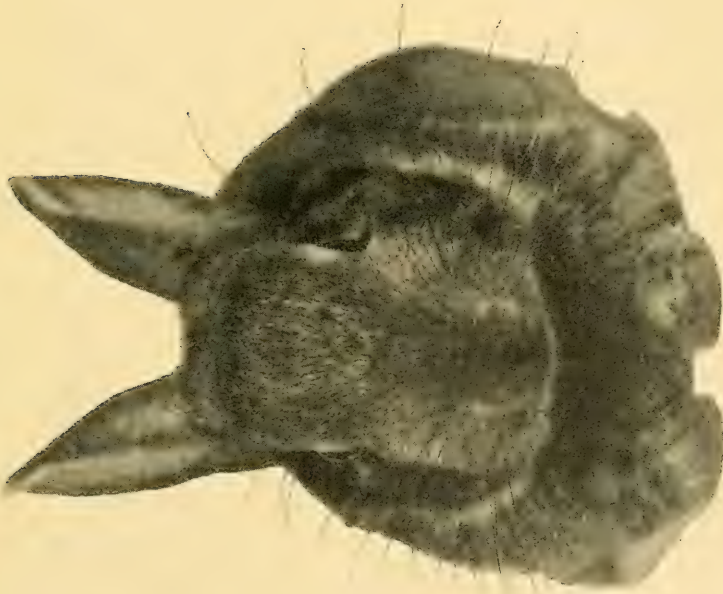
Numerous **colour variations** occur, and have been long known. They must have been familiar in the sixteenth century according to Gesner (see above, p. 184); Merrett described two as "griseus argenteus" and "niger" in 1666; and about the same date (1675) black rabbits were noticed on an island off Ireland (Westropp, *Proc. Roy. Irish. Acad.*, "Clare Island Survey," pt. 2, Dec. 1911, 75). A passage from Chaucer's *Romaunt of the Rose* was quoted by Rolleston (*op. cit. supra*, p. 193), and would at first sight seem to point to varieties having been familiar objects in the fourteenth century. It runs as follows in Bell's edition of 1855, vii., 60:—

Conies there were also playing,
That comen out of her claperes
Of sundry coloures and maneres,
And maden many a turneiying
Upon the freshe gras spryngyng.

Skeat has, however, most obligingly informed me that the above lines, although undoubtedly written by Chaucer, are a translation from an older poem, *Roman de la Rose*, written about 1260-1270 by the trouvères of northern or central France (see Skeat's "The Student's Chaucer"). According to a quite common custom of Chaucer's,



(2)



(1)

HEADS OF (1) MALE AND (2) FEMALE RABBIT, to show sexual differences. Photographed by G. D. Croker, Waterford, from specimens obtained at Kilmanock, Co. Wexford, and arranged by M. Parle, gamekeeper.

the first line also did duty in the *Assembly of Fowles* (see above, p. 183); the French original is:—

Connins i avoient qui isoient
Toute jors hors de lor tesnieres,
Et en plus de trente manieres
Aloient entr'eus tornoiant
Sor l'erbe fresche verdoiant.

The words "of sundry coloures" are not in the original, and were added by Chaucer to fill up the line. Further, Skeat adds that "colour" is but a vague word in Early English; if Chaucer had intended the expression to mean much, he would have used the word "hew-es"="hues," a native word, the meaning of which was open to no doubt, and which would have filled up the line all right. The passage, therefore, signifies nothing except that rabbits were well known in northern or central France in about 1260-1270.

The most conspicuous colour variations are whole blacks, yellows, browns, silver-greys, or rarely, whites; the silver-greys are usually black in their first coat, and, like grey horses, which start life as blacks, arrive at their final coloration by subsequent assumption of white hairs. Black varieties may be distinguished at birth from the normal type; in the former the pigmented skin is darker and covers the whole body; in the normal the ventral area is pink or flesh-coloured (Hurst, *op. cit.*, 303). There are also parti-coloured varieties, and one or other of the above are sometimes so numerous in warrens as to outnumber the type; for instance, at Hawkstone, Salop, late in the nineteenth century, the late Lord Hill, after unremitting selection through several years, succeeded in establishing a race of pure silver-greys. Sometimes one or other of these varieties appears suddenly in numbers in a definite locality, thrives for a time, and as suddenly disappears. One with long silky hair was mentioned in 1816 by Neill (see also Fleming) as inhabiting the Isle of May and other islands in the Firth of Forth; it was still there down to 1887, and at one time appears to have been in exclusive possession. It is now, however, no longer in existence, having probably been "swamped," as William Evans informs me, by repeated introductions of the ordinary form. Sunk Island, on the Humber, was once famous for a mouse-coloured race, which was extirpated on account of the damage which it caused to the banks (Chamberlayne, *Phil. Trans. Roy. Soc.*, London, 1719, No. 361, 1014-1016; Pennant, *British Zoology*, ed. 2, 1778).

Space does not permit a discussion of the numerous artificially created **domestic forms** of the Rabbit. Many of these are very distinct, both in colour and form, perfectly stable, and breed true. But they can all be traced to the wild parent form, although it is not known when or how it was first domesticated. Neither the ancient Romans nor the Spaniards (see p. 184), mention any domesticated forms.

The 'Himalayan,' a white form, with symmetrical brownish-black ears, nose, feet, and upper side of tail, was described as distinct by Bartlett (*Proc. Zool. Soc.*, London, 23rd June 1857, 159), under the name *Lepus nigripes*; it can, however, be produced by mating silver-greys with the form called 'Chinchillas,' or light silver-greys (Bartlett, *Proc. cit.*, 1861, 40). The study of these varieties has become a separate branch of science, and they are dealt with in detail by fanciers and Mendelians, whose works must be referred to for further information (see Hurst's paper, mentioned above).

Room must, however, be found for a summary of recent work on the causation of yellow, black, and other varieties, a subject which has been considerably elucidated by recent investigations (see Castle, *Science*, 25th January 1907, 151-153; 30th August 1907, 287-291; 21st August 1908, 250-252; Hurst, *op. cit.*).

In a rabbit of normal, or, as Mendelians term it, "agouti" coloration, the pigments of the hairs are laid down in rings as described above, due to a definite cycle of activity in the hair follicles, which form the pigments in a regular sequence. In instances of colour variation the hair follicle may cease to form the pigments in sequence, with the result that they are mixed, instead of being segregated, or, on the other hand, one or more of them may be absent, or present in variable quantity, resulting in various shades of pigmentation.

The normal individual is apparently possessed of several factors:—*Ri*, the factor for ringed hair; *Bl*, the factor for black pigment; the latter possibly mixed with another factor, *Br*, that for brown or chocolate pigment, which is known to be present in mice and cavies; and *Ye*, the factor for yellowish or reddish pigment. An individual lacking *Ri* is black, the black colour being so abundant as to conceal the also present yellow or brown. If a further factor *Bl* be lost, a yellowish or rufous race results. Thus in uniformly coloured rabbits something is lacking which is present in the normal individuals, and it is remarkable that varieties lacking the factor *Ri* and possessing unbarred hair always lack also the white colour of belly and under side of tail which is due to absence of pigment from the terminal portions of hairs in these regions. Blue or blue-grey rabbits are individuals possessing black pigment in a dilute form, while the yellow apparently remains scanty in amount.

White specimens are not, as regards colour, necessarily negative, that is, entirely lacking the power of forming pigment, although some of them may be so, and are then true albinos. Many white individuals lack an æstivating or ferment-like substance, without which pigments cannot be made visible; but in other respects they carry all the colour potentialities of pigmented individuals, which is shown by the results of crosses between the two classes. White specimens may thus occur in any of the above-mentioned categories.

Besides the factors for the various colours there are also factors for formation of patterns, and these are equivalent to partial inhibition of pigment.

The above-mentioned facts are probably true, not only for rabbits, but for covies and mice; but the subject has been pursued further in the two latter than in the former animals, and for a further account of it reference should be made to the article on the House-Mouse.

Geographical variation:—There are two sub-species, viz., *O. cuniculus cuniculus* (Linnæus), the subject of the present article, and *O. c. huxleyi* (Haeckel, *Hist. de la création des êtres organisés d'après les lois naturelles*, 1874, 130). The latter was described from Porto Santo, near Madeira, where it was introduced about 1418; it is found also in the Azores and Salvage Islands between the Canaries and Madeira. It was noticed in Crete by Bate, and renamed *O. c. cnossius*. It is found throughout the Mediterranean region, and is a small grey form with the hind foot (including claws) reaching only 75 to 85 mm. *O. c. cuniculus*, besides being the Rabbit of the British Islands, is also that of Europe, north of the Mediterranean region.

Hybridism:—See under genus *LEPUS*.

Dimensions:—See table on next page, wherein only specimens considered to be fully adult are included in the averages; but it is difficult to obtain a number of adults, and it is probable that really old rabbits are comparatively rare, so that an average, to be natural, should include some sub-adults. Although the items are variable, the averages of each lot, except in length of head and body, a measurement difficult to obtain invariably under precisely similar conditions, are very uniform. The length of the hind foot depends on the condition of the claws, and that of the head and body on the treatment which the carcase happens to have received.

Skull (range of nine specimens in British Museum of Natural History):—Occipito-nasal length, 78 to 82; condylo-basal length, 68.6 to 72.8; zygomatic breadth, 37.2 to 41.4; breadth at intero-orbital constriction, 12.4 to 15; breadth at post-orbital constriction, 11 to 14; breadth of brain-case, 27 to 29.8; nasals measured by diagonal, 35.4 to 38; greatest breadth of both nasals together, 14 to 17.2; length of diastema, 22.4 to 24; length of mandible, 59 to 63.4; length of maxillary tooth-row, 14.2 to 15.6; length of mandibular tooth-row, 14.2 to 16.2.

Weight (in lbs. and oz.):—This depends to a great extent on the nature of the ground, the food and the time of year. On the analogy of the hares, does should be heavier than bucks, but the latter appear to the eye to be more massively built, and Simpson (*op. cit.*), Cocks, and others find that they are, as a rule, larger and heavier than

DIMENSIONS IN MILLIMETRES:—

	Head and body.	Tail.		Hind foot, with claws.	Ear.		Weight.	
		Extreme length.	Vertebrae.		To notch.	To nape.	Lbs.	Oz.
MALES FROM KILMANOCK, CO. WEXFORD :—								
1. 5th January 1911 .	406	93	71	95	68	84	..	..
2. Do.	406	89	60	94	63	73	..	..
3. Do.	406	90	68	90	62	78	..	..
4. Do.	406	93	71	99	68	75	..	..
5. Do.	419	82	65	99	69	76	..	..
6. Do.	406	81	64	91	70	78	..	..
7. 3rd March 1911 .	457	104	81	100	68	..	..	..
Average of 7 .	415	90	68·5	95·5	66·8	77	..	..
FEMALES FROM KILMANOCK, CO. WEXFORD :—								
1. 20th Dec. 1909 .	432	82	62	88	66	..	..	..
2. Do.	432	82	61	88	70	..	..	..
3. Do.	432	85	63	86	64	..	..	..
4. 5th January 1911	412	98	66	92	64	79	..	..
5. Do.	406	98	80	98	66	75	..	..
6. Do.	419	97	74	105	69	74	..	..
7. Do.	406	94	74	94	69	76	..	..
8. Do.	393	95	66	96	64	70	..	..
9. 3rd March 1911 .	393	86	65	93	66	77	..	..
10. Do.	406	91	76	94	68	76	..	..
11. Do.	419	101	69	98	69	..	..	..
12. Do.	457	96	69	97	71	..	..	..
13. Do.	444	100	65	94	65	..	..	..
14. Do.	438	102	65	90	63	..	..	..
15. Do.	419	98	70	84	66	..	..	..
16. Do.	444	97	68	93	68	..	..	..
Average of 16 .	422	94	68	93	66	75 (7 items)	..	..
17. Sub-adult, 3rd March 1911 (man- dibles ankylosed, but ear tearable)	431	..	..	87	..	..	..	..
18. Immature, 13th Jan. 1911 . . .	279	81	55	78	58	72	..	..
19. Do., 10th Aug. 1911	320	84	59	75	57	70	..	..
20. Do., 5th Sept. 1911	180	..	26	45	34	..	..	..
FEMALES FROM OTHER LOCALITIES :—								
21. Tidmarsh, Berk- shire, 10th Dec. 1896 *	392	..	64	86	70	..	..	..
22. Ditchling, Sussex, Sept. 1908 *	386	..	77	85	69	..	..	..
23. Do. do.*	385	..	71	86	69	..	..	..
24. Lezayne, Isle of Man, 10th Dec. 1900 *	437	..	66	91	70	..	..	..
25. Clondeboye, Co. Down, Ireland, 10th Feb. 1905 *	408	..	63	85	65	..	3	4·25
Average . . .	401	..	68	86	68	..	..	..
Average of both sexes in all tables . . .	416	93	68	92	67	76	..	..
Proportionate lengths (approximate), head and body being re- duced to 100, and all other dimensions proportionally .	100	22	16	22	16	18	..	..

* These particulars were copied from the labels on specimens in the British Museum of Natural History.

the does. The two sexes are, however, in this respect so similar that discrepancies are probably due to the disturbing influence of the sexual functions, present through nine months of the year.

Numbers of rabbits have been weighed by sportsmen and naturalists, who have published details of a few specimens reaching well over 5. But after long experience as an editor of the *Field*, Harting (*Field*, 17th December 1898, 981, and *op. cit. supra*) put the average at 3 to $3\frac{1}{2}$, and could not vouch for any heavier weight from personal experience. Reliable correspondents had, however, sent him notes of several over 4, and of two, apparently wild, of 4^{13} and 4^{14} respectively. He believes that every instance of weights exceeding 5 is due to the turning down of domestic animals, as is frequently done in order to increase the size of the wild stock. Simpson writes (*Field*, 24th December 1898, 1014) very much in agreement with Harting, reporting that having weighed many in October, when they are at their best, none exceeded 2^8 or 2^{12} , paunched, which weight he considers the average, although on good pasture another pound might be added. Owing to the numbers of small, ill-fed specimens sent to the markets from poor warrens, the general average of those handled by big dealers is said by Simpson (*op. cit.*, 35) not to exceed 2 when paunched.

At Kilmanock, Co. Wexford, where there is no record of any rabbits having been turned down for many years, in December 1887 nineteen totalled about 65^8 , averaging 3^7 , the heaviest being almost 4. A large one, specially selected for its size, on 1st January 1892 was also under 4. It should be noted that an accidentally emasculated buck would attain a weight much above the average, and such an individual might account for the specially heavy weights occasionally recorded.

Distinguishing characters:—The size of the Rabbit is quite distinctive. The hind foot, including claws, rarely measures above 100 mm., as compared with at least 130 in the hares. The best way to distinguish a quite young one from a leveret of *L. europæus* is by its grey rather than ochraceous colour. As compared with the Scottish and Irish hares the long tail is characteristic; this, including the hairs, is usually about equal to, or slightly shorter than, the hind foot, whereas the hind foot of a young hare may be double the length of the tail.

Apart from its small size, the skull may be distinguished (amongst other characters) by the narrow posterior nares, always narrower than the breadth of the bony palate; the narrow superciliary processes; upper incisors with roots not visible through the bone; and the deep anteriorly thickened zygomata.

The Rabbit is one of the commonest British mammals, but its habits present many points of interest, which in some

respects cannot be considered better known than those of rarer and less familiar species.¹

As compared with a hare, it is a generalised animal, a digger and yet a runner. But although it digs, and digs well,² its skill in this respect has not been accompanied by the serious loss of locomotive powers which specially fossorial limbs impose upon their possessors.

It is, however, unfitted by its organisation for that long continued and rapid course by which the hares are distinguished. Instead, it seeks safety and shelter in deep holes of its own construction, and in places where the work of excavation is easy it associates in large societies. A big burrow is a very complicated excavation, which may descend to a depth of several feet, and does not seem to be built on any specified plan. In fact, its ramifications³ are the result of the promiscuous activity of many generations of inhabitants, each member of which has from time to time taken a turn in an unorganised way at improving it. Certain features are, however, common to all burrows. The main entrance or entrances are constructed from the outside, and may be easily recognised by the bare spaces at their mouths, which are formed by the excavated soil. This is kept free of vegetation by the passing and repassing over it of the inmates, which also sit on it, and leave there a portion of their droppings. Sometimes also a bone or two of defunct rabbits, or the remains of the old bedding used in a nursery, are recognisable. The inhabitants do not allow large heaps to accumulate in front of or around their burrows, but work the soil away from the entrances, so that it forms long, narrow, rather furrow-like mounds of shallow height; and, if the burrow opens on the side of a hill, the soil is always thrown downwards in the easiest direction. A feature

¹ Indebtedness is gladly acknowledged in preparing this article to two works on the Rabbit, by J. E. Harting and J. Simpson, the titles of which are mentioned above on pages 178 and 191.

² "It can soon drive a tunnel into the hardest loam or dry clay; and I have known it burrow deeply in a surface seam of coal, and scatter the lumps yards away from the entrance."—Simpson, *op. cit.*, 16.

³ Few plans of burrows seem to have been published, but there is one in P. Anderson Graham's *Country Pastimes for Boys*, 1908, 300, fig. 171; another in Miss M. D. Haviland's *Lives of the Fur Folk*, 1910, 89; and some simple ones in Owen Jones and Marcus Woodward's *Woodcraft*, 1910, 89 and 92.

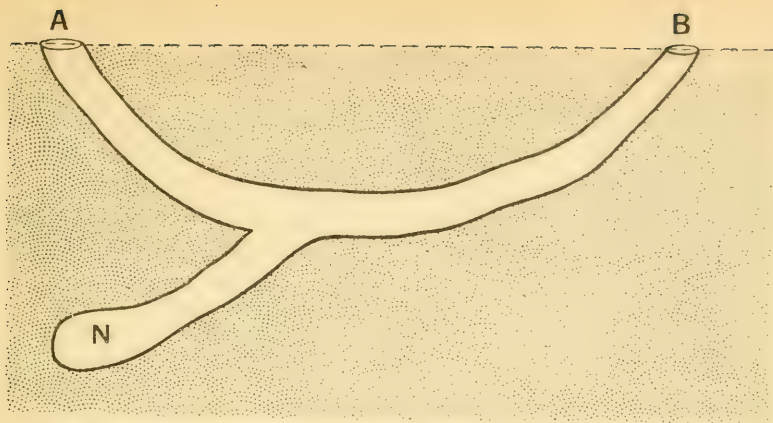


FIG. 35.—SECTION OF SIMPLE BURROW IN OPEN FIELD.

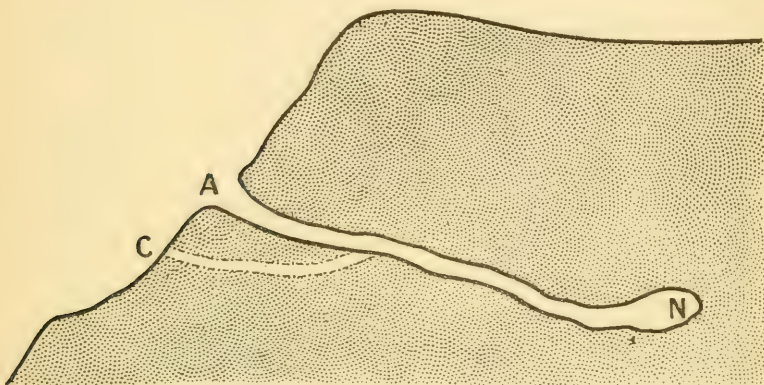


FIG. 36.—SECTION OF OLD RABBIT BURROW (C) ; enlarged by fox and badger (A).

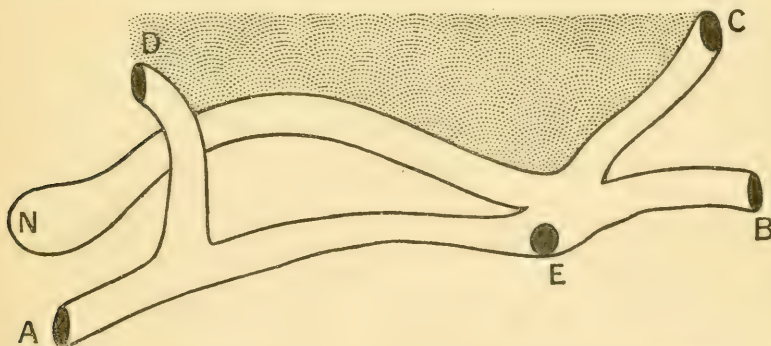


FIG. 37.—PLAN OF COMPLICATED BURROW WITH FIVE ENTRANCES.
From A to B is 45 feet.

The above are diagrammatic, and N is the sleeping compartment or nursery ;
A, B, C, D, E are entrances.

Figs. 35, 36, 37 drawn by G. Dollman, from information supplied by Owen Jones.

of the mounds of excavation is that they generally have fairly definite edges, yet there is so little soil at the mouth of some big burrows that it must also be scattered broadcast. Sometimes a worker, either finding the labour too heavy in the original direction, or, for some other reason, changes it, so that the mound bifurcates.

Exactly how the work is performed is a debatable question. The main labour of digging must always, of course, fall upon the fore paws, assisted, where an obstacle such as a stone has to be removed, by the teeth.¹ In removing the soil, no doubt the usual method is to pull the material backwards with the fore feet, throwing it out bodily between the hind legs when necessary. Sometimes the animal walks backwards, working its hind feet alternately, and their action is so strong that it results in scattering the soil for a distance. As Mr Owen Jones has well put² it, the fore feet are used for throwing back the soil a little way, the hind legs for flinging it a long way. Mr Jones informs me that he has twice seen a rabbit thus flinging back the excavated earth, and on one occasion he was at such close quarters that he caught the operator by a hind leg with his hand. The action in both cases closely resembles that of a dog, which in its vigorous backward cannonading may often reach a man's eye.

Although most of the burrows are constructed from the outside, there are always a certain number of entrances which show no excavation mound, and have evidently been opened from the inside. The latter frequently go down almost perpendicularly for a distance of three or four feet, and their mouths are small, devoid of bare spaces around them, and usually concealed by vegetation. These are the emergency exits, scoot-, scout-,³ or pop-holes, which a rabbit uses only in order to escape from an enemy inside the burrow. They often present an appearance of having been ingeniously concealed; but it seems probable that this is due rather to accident than to a display of forethought⁴ on the part of the rodents. Indeed, most holes

¹ Richard Kearton, *The Fairyland of Living Things*, 1907, 80.

² *In lit.*, 15th April 1911.

³ From "scoot" = to make off quickly.

⁴ As against this, however, is the fact that in sandy and loamy soils an excavation may be carried to within a half inch or so of the surface. When pressed by an enemy from within, a rabbit will push through the thin, unexcavated portion and escape.



RABBITS.

that are not frequently used soon become, in the natural course of events, hidden by overgrowing vegetation, and where vegetation is scarce, as on a bare hillside, scout-holes may be as conspicuous as the regular entrance holes.

The mound of excavation is frequently added to and freshened by renewed digging, especially in autumn, when the inmates seem to be restless, and are, perhaps, unconsciously preparing for the approach of winter; or, it may be, that the autumnal outburst of activity is due to the return home of sojourners above ground during the warm weather.¹

The occupants of an ordinary "burry" sleep on the bare earth, in chambers running off blindly from the passages. Their main object is evidently to escape damp and draughts. Warmth is probably secured by several animals huddling up together, for no bedding materials are ever carried in for the use of the adults.

The size and capacity of some burrows may be best realised by considering the number of animals of different species and habits which may be found in them. Thus Col. E. A. Butler informed Mr J. G. Millais that on one occasion when ferreting he bolted a fox, a cat, a stoat, and several rabbits and rats out of the same earth. It is difficult from the outside to imagine the arrangement whereby a menage composed of so many mutually hostile elements came to be carried on. Probably the smaller occupants construct and retire to passages of suitable diameter, where they are safe from their dangerous fellow-lodgers. Besides this, the interior must be intensely dark, and the atmosphere so "thick" and full of mixed odours, that the exquisite powers of scent possessed by both rodents and carnivores cannot be brought into play, so that they must depend on their hearing and touch for knowledge of their neighbours. The result is that a close approach is possible by mutually antagonistic animals, which can thus enjoy in common a home offering exceptional comfort; and that, so far as the Rabbit is concerned, means

Henry Laver writes me that in the light soils of Essex these uncompleted bolt-holes are very common, and that he has seen scores of rabbits escape in this way.

¹ See Owen Jones and Marcus Woodward, *A Gamekeeper's Notebook*, 1910, 212.

dry lying in the immediate neighbourhood of good rich pasture.¹

The large rabbit-burrow, of which Fig. 38 is a plan, was selected for examination on account of its situation in an open field, where, the soil being stony, the rabbits were not likely to tunnel deeply underground. This expectation was realised, no portion of the passages having a greater depth at its floor than 28 inches, and most of the floors lying only about 18 inches below the surface. With two exceptions, the tunnels are drawn in one plane, but the distance in inches from their floors to the surface of the soil is indicated. The average diameter of the tunnels was about 6 inches, increasing at certain situations, so as to reach about 1 foot, in at least one direction, but not being truly circular.

There were, excluding the two short blind tunnels marked B, B, seven openings to the exterior (A, A). The works were divided into two sections, the neighbouring mouths of which opened into a shallow pit or depression (H) shown near the middle of the plan. This pit had the appearance of having originated through subsidence caused by active digging close to the surface. The four tunnels opening into this pit may at one time have been continuous, and their mouths must certainly have been originally much closer together. While engaged in excavation, a foot of one of the men penetrated and exposed a portion of the blind terminal opening into the pit, and it would have taken very little working on the part of the rabbits to convert this into another mouth.

The burrow was remarkable for its abrupt, as well as for its gradual turnings; the former, no doubt, often owed their existence to the difficulty of carrying on the tunnels in the direction originally intended through the hard ground. This is what had probably happened at D, and in other places where short blind alleys or increases of diameter are marked in the plan; in other cases the chambers may be regarded as incipient tunnels. One or two enlargements (N, N), either terminal or lateral, were obviously sleeping or resting places; but these were seldom encountered; one contained two pellets of droppings.

Two remarkable circular tunnels will be noticed at F, F, and

¹ Simpson, *op. cit.*, 16.

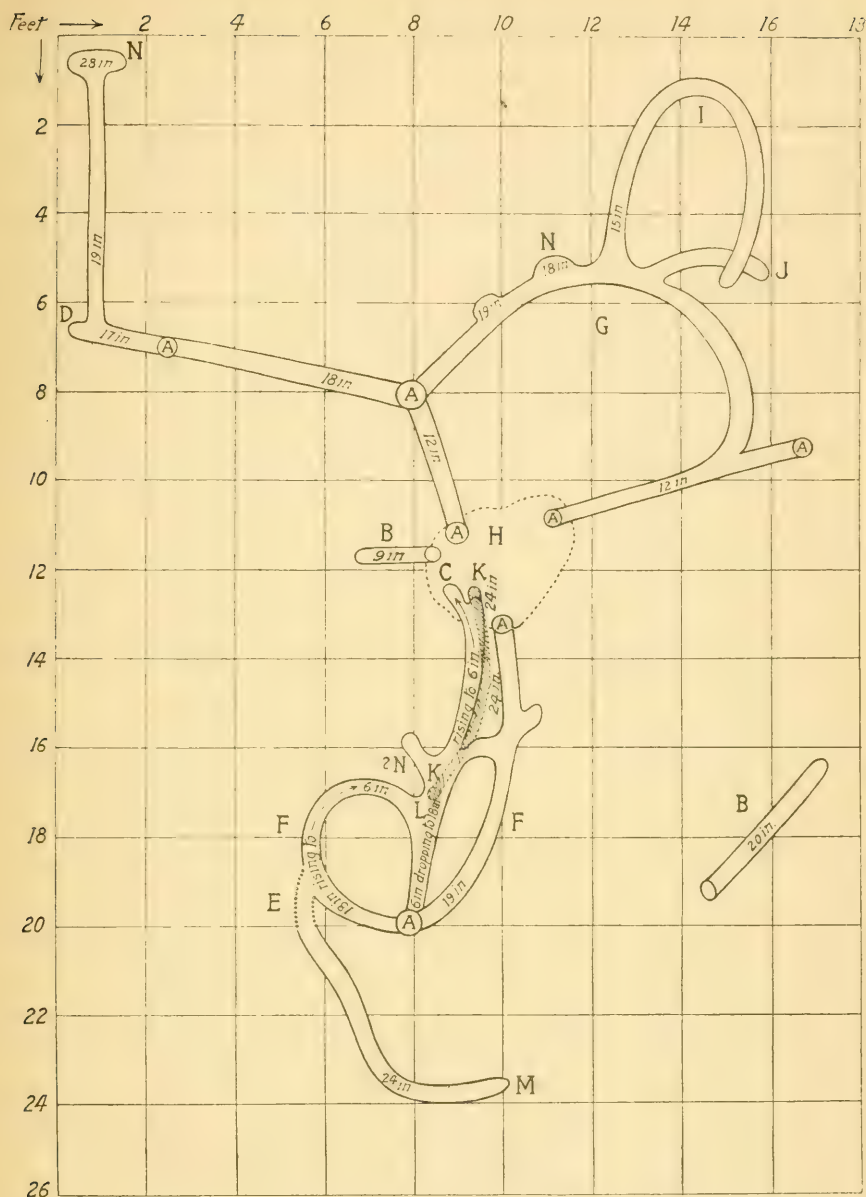


FIG. 38.—PLAN (Diagrammatic) OF A RABBIT-BURROW AT CAPPAGH, CO. WATERFORD, excavated by permission of R. J. Ussher, 12th December 1911.

From a sketch by G. E. H. B.-H.

a third larger one at G, which would serve excellently the purpose of enabling the inhabitants to avoid the pursuit of a stoat or ferret. At I is shown an uncompleted circular gallery, the termination of which lies above another deeper gallery J. A second deep gallery (K, K) is shown by shaded lines; its mouth (L) opened on the floor of one of the main tunnels. A tunnel ending blindly at M was not traced so as to connect with the main burrow, but its probable course is indicated by the broken lines at E.

The appearance of the galleries was cold and uncomfortable, and it is believed that they are not much used in winter.

In Fig. 39 is shown a plan of a second rabbit-burrow, which, having been constructed in ordinary soil, descended to a greater depth than that shown in Fig. 38, and was more difficult to excavate. Although the diameter was on the average broader than that of No. 38, it was in places, as at Z, even smaller than the latter. There was only one sleeping place (N), but the excavation was, for lack of time, not completed, and the burrow may possibly have communicated by U with the partially excavated tunnel Y.

Sandy heaths covered with furze are favourite resorts of rabbits. The soil is easily penetrated, and the furze affords at once a secure cover for retreat, and a wholesome and never-failing supply of food; the young tops of the plants are constantly eaten down, and the bushes present the appearance of a solid mass, with the surface rounded off evenly as high as the animals can reach when standing on their hind legs. On moors, where the soil is very wet, they often refrain from burrowing, and content themselves with runs and galleries formed in the long, matted heather and herbage.¹ In such localities they lie like hares in "forms," and it is no doubt this propensity, which is always very evident in fine weather when cover is abundant, that has given rise to the popular belief amongst sportsmen that there are two distinct varieties. One, the ordinary or "burrow rabbit," is known in Hertfordshire and

¹ As in heather and crowberry on Boar Flat moor, at the head of Swineshaw Valley (Cheshire), near Oldham; and on a large scale on the Peak hills of Kinder Scout, Derbyshire, F. J. Stubbs, *Report Oldham Microscop. Soc. and Field Club*, 1905-6-7, 30, 1908, and in *lit.* This is the normal habit of the Mexican Pygmy Rabbit *Romerolagus nelsoni*; see E. W. Nelson, *North Amer. Fauna*, No. 29, 280.

Kent as the “stub-rabbit”;¹ the other is called the “bush rabbit” in Ireland,² as well as in other localities—for instance, in Bedfordshire, Hertfordshire, and Surrey.³

A rabbit-warren presents towards evening a curious and not uninteresting spectacle. The ground everywhere pierced

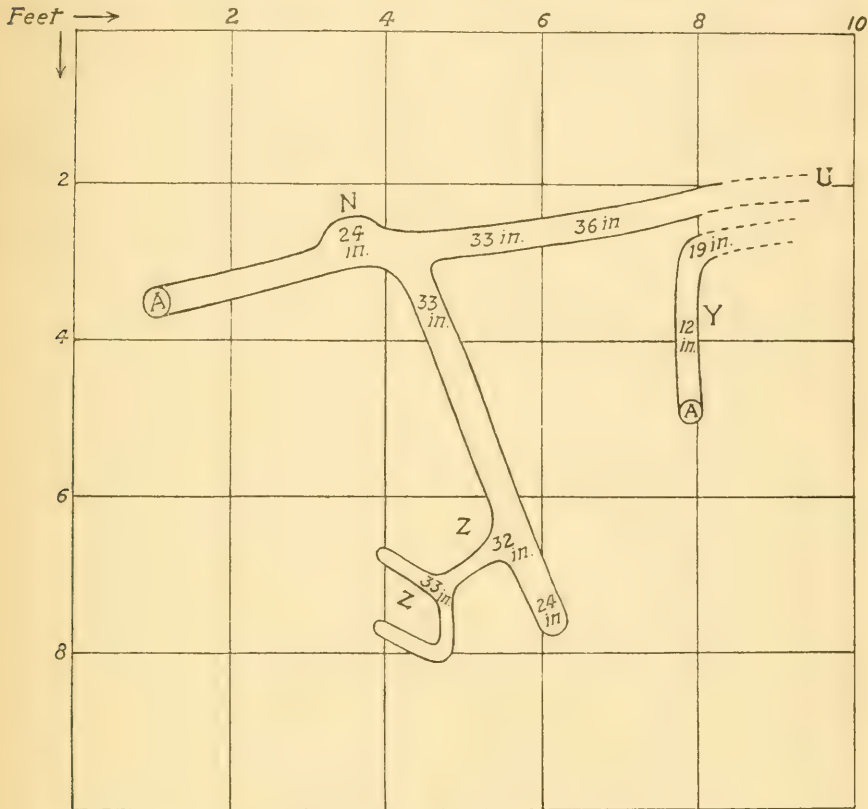


FIG. 39.—PLAN OF A PORTION OF A SECOND BURROW PARTIALLY EXCAVATED AT CAPPAGH, CO. WATERFORD, by permission of R. J. Ussher, December 1911.

From a sketch by G. E. H. B.-H.

with deep and tortuous holes, the absence of all esculent vegetation for some distance round, and the playful gambols and rapid retreat of the inhabitants, as they either sport in security or fly from the approach of danger, are circumstances which at once indicate the peculiar habits of the species and present a lively and amusing scene.

¹ Rev. G. F. Dawson, *Zoologist*, 1845, 903; see also 969.

² William Thompson.

³ L. E. Adams.

The Rabbit is certainly polygamous when abundant. The doe is evidently polyœstrous, with a long sexual season, and her several litters may appear during winter as well as in summer, but much less frequently between September and December,¹ or, in cold northern localities, between September and February.² The period of gestation lasts for thirty days, and from three to five or six young are most usually brought forth at a time. Instances are known in which the number found together in a nest amounted to eleven,³ and even to fourteen,⁴ but possibly the larger numbers may have been due to superfœtation, or to a combination of the litters of two mothers. The doe is believed to commence breeding when six months old, but since a rabbit becomes fully grown in about three months, and the domestic forms breed at the latter age, that period may be regarded as marking the advent of sexual maturity in wild does also, although no definite observations appear to have been placed on record.

Since the breeding season, in the south at all events, lasts nearly throughout the year, and since several litters may be born of one mother in a year, the number of young in each case depends on the season. As the result of over four years' observations in South Buckinghamshire, Mr A. H. Cocks finds that the average number in a litter increases from between two and three in October to nearly six in June, and then drops again to October. The average is five (plus different fractions) for March, April, May, June, and July. The rise or drop is gradual, except between September and October (downwards) and November and December (upwards). The ratio of the number of litters corresponds fairly well with the monthly average of young per litter, being probably greatest between March and June, and the reverse in October and November, but the proportional rise and fall is much greater. Mr Cocks met with eight young on four occasions in May, June, and

¹ For an instance of midwinter young under extremely unfavourable circumstances, see J. A. Harvie-Brown's account (*Zoologist*, 1867, 604) of a breeding-nest composed entirely of rabbit's wool placed under four inches of frozen ground at Dunipace, Stirlingshire, Scotland, in early January.

² Simpson, *op. cit.*, 20.

³ *E.g.*, E. R. Alston in Bell, ed. 2, 345; once at Kilmanock.

⁴ George Sim, 72, on the authority of a keeper.

July, and nine once only, viz., on 29th March 1901. They are born blind and deaf, and nearly naked, and are thus unlike leverets, which are covered with fur and have the eyes open at birth. The ears are said not to gain the power of motion until the tenth day; on the twelfth they are completely open, and on the thirteenth they may be erected. Sight begins on the eleventh,¹ and shortly afterwards the young leave the nest for short periods preparatory to their final exit. They probably eat grass as soon as they can run, and are independent of their mother by the third or fourth week.

Messrs C. S. Minot and E. Taylor² have studied the rate of growth of young rabbits both before and after birth, and find that from the ninth to the fifteenth day the embryo adds 704 per cent. to its weight daily. Afterwards the average daily addition drops enormously, being only 212 per cent. from the fifteenth to the twentieth day. The figures suggest that in younger embryos the rate of increase may be very much greater, amounting to possibly over 1000 per cent. per day before the ninth day. Four days after birth a young male rabbit is capable of adding over 17 per cent. to its weight in a single day. The percentage increment then drops rapidly, until at the age of twenty-three days the addition is only a little over 6 per cent. each day. After about the fifty-fifth day the decline in the growth rate becomes more gradual.

The doe pairs again within a few hours after the birth of her young, and if no conception results, pairing takes place again at intervals varying from ten to twenty-one days, until either pregnancy ensues or the sexual season terminates.³ She is frequently found to be pregnant whilst suckling a previous litter. Superfoetation is said to occur, but must be very rare indeed, since Mr Jones, although he has paunched thousands, has never noticed a case of it, and other game-

¹ *Fide* Harting, *op. cit. supra*, 8, footnote, apparently from W. B. Daniel, *Rural Sports*, 1801, i., 495; Daniel, however, got the fact from Cartwright, who wrote of domestic rabbits in his *Journal on the Coast of Labrador*, 1792, but, the latter work being without an index, I have been unable to find the original passage.

² "The Problem of Age, Growth, and Death," *Popular Science Monthly*, lxxi., 1907; reprinted London, 1908; see also Normentafeln zur Entwicklungsgeschichte der Wirbelthiere (Jena); No. 5, 1905.

³ W. Heape, *Quart. Journ. Microscop. Sci.*, 1900. See F. H. A. Marshall, *The Physiology of Reproduction*, 1910, 41.

keepers have given similar testimony. Mr Cocks has, however, met with one instance; and other cases of the production of litters at intervals of from two to nine days have been placed on record.¹

It is evident from the above facts that the multiplication of this species is extremely rapid;² so much so that although, until the recent fall in prices, it was capable of yielding, if properly managed, both profit and pleasure to sportsmen, on arable farms it often becomes an intolerable scourge to the agriculturist, unless its numbers are constantly kept in check. Since the destruction of our native beasts and birds of prey, most of which are very fond of rabbit's flesh, its most deadly foe is man, who pursues it with guns, traps, nets, dogs, and ferrets. But rats are no mean rivals, and in the summer they live to a great extent in rabbit-burrows, where they kill and eat the young; and domestic cats are also very fond of poaching.

The effect of rabbits on a local flora is often more considerable than is generally known, and is both destructive and constructive. The original vegetation is usually destroyed in the immediate neighbourhood of a warren, to be replaced by a new flora. The details are, no doubt, different according to the locality and the nature of the soil. On good land the grass gives way, and thistles, nettles, and other weeds gain a footing from which it is hard to eject them. Where the soil is loose, as when there are sandhills, the damage is most marked.

The interaction of rabbits and vegetation in Breckland, a big sandy district surrounding the town of Thetford, on the borders of Norfolk and Suffolk, has been studied by Mr A. Wallis.³ He has shown that grass, gorse, and ling are destroyed by being eaten, and sand sedge, for which the rabbits have no liking, then flourishes. But burrowing on a large

¹ G. Griffiths, *Field*, 4th October 1890, 501 (two litters of six each, at interval of two days); J. E. H. Hasted, *Field*, 16th April 1892, 545 (litters of four and three, with five days' interval; litter of two, followed nine days later by litter of one).

² The rate of multiplication has, however, been frequently exaggerated, and a commercial estimate of the average number reaching a good saleable size from a single pair in one season is, even in a favourable climate, not over twelve to fifteen (Simpson, *op. cit.*, 20).

³ In J. E. Marr and A. E. Shipley's *Handbook to the Natural History of Cambridgeshire*, 1904, 226-228.

scale produces at first what are practically deserts. "The rabbits," writes Mr Wallis, "bore into a gently sloping hillside, the soil falls down, a slight escarpment is made, and they bore again. This process, continually repeated, gives rise to considerable extents of loose sand, bounded on the upper side by a miniature cliff full of burrows, on the lower side merging almost imperceptibly into the hillside. The action of the wind upon the loose sand is such as by purely mechanical means to prohibit the growth of any vegetable life, but where stones offer any protection against the moving grains, *Cladonia* (lichen) will often be found. This may either cover in time the whole bare area, or give way to *Festuca ovina* (sheep's fescue-grass), which in turn gives way to *Carex* (sedge). Towards the lower edge the *Cladonia* increases considerably, with here and there a tuft of *Festuca ovina* and the straight lines of *Carex* shoots, until the normal growth of the undisturbed hillside is reached."

One class of plants seems to owe its existence in Breckland entirely to the rabbit-burrows. They are the annuals, always rare plants in the sandy wastes of this district, and especially those called cornfield annuals. These appear on the excavation heaps of burrows which are little frequented or disused, and amongst them may be mentioned the hemlock, storksbill, wall and vernal speedwells, early and changing forget-me-nots, the field cudweed, and the early hair grass. Later on the annuals are succeeded by perennials, differing, however, from those found growing on the surrounding soil. These perennials "seem to hold their ground well, particularly if the ground is loose and very dry, as is the case upon the hillocks which are so often chosen by the rabbits for their holes."

According to Mr Wallis, the annuals "depend for their very existence upon constant and regular disturbance of the soil. Originally such plants, in those portions of the world where they had not invaded the cultivated land of primitive man, must have led a precarious existence upon landslips, bare and crumbling river banks, but principally upon the earths of burrowing animals. It is on the rabbit earths, and on these alone, that in the wilder portions annuals can exist. We see to-day the rabbit performing, in this quiet corner of England, his ancient role of agriculturist."

The influence of rabbits on the general fauna of the country is probably not less important than on the vegetation. The universal habit of trapping these rodents has everywhere resulted in a great destruction of all the carnivora, even where there existed no special intention to destroy the latter. It may safely be said that indiscriminate and unsupervised trapping of rabbits must eventually end in the complete extermination of every animal using their burrows, except the most noxious of all, the rats, and even these are killed in large numbers by rabbit-trappers.

When the doe is about to give birth to her young, she frequently forms a separate burrow, generally known as a "stop" or "stab," a few feet long, at the bottom of which she makes a warm nest of grass or moss, lined with fur plucked from her own belly. This breeding-burrow is often placed in an open field far away from any warren, and it has only one entrance. The mother covers over this single entrance with earth, which she rams in very tightly, and, unless in exceptional circumstances, visits her offspring only under cover of the night. When the young bunnies are nearly old enough to come out and run, she leaves a small opening in the plug, which opening is allowed to increase daily until the time of final exit.¹ Mr Kearton² has published two photographs of a breeding-nest, both blocked up and open, and states that in this particular case some hay had been taken from a sheep-foddering station close by and scattered over the closed entrance. No doubt the object of the special breeding-nest is to protect the young from the murderous propensities of the polygamous males, quite as much as from carnivorous enemies.

But a great number of young are dropped in the main burrows,³ without any partition to separate them from its other occupants, and over these, no doubt, the mother keeps watch during the day and for a portion of the night. The instinct to secrete the young is, therefore, only partially

¹ Jones, *Woodcraft*, 92.

² *Op. cit.*, pp. 178-79.

³ Jones writes me that he has dug out hundreds of new-born young from ordinary burrows, none of which showed any signs of having been stopped. On 5th May 1886 I found two such litters of different ages in separate parts of a single burrow.

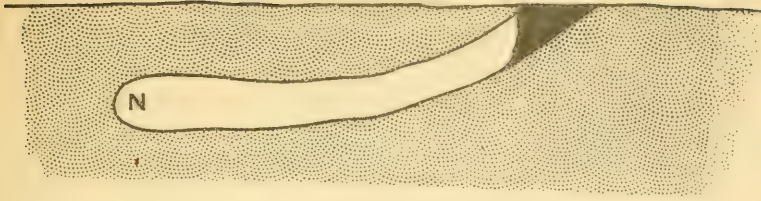


FIG. 40.—SECTION OF CLOSED STOP OR NURSERY.
(Length, 4 or 5 feet.)

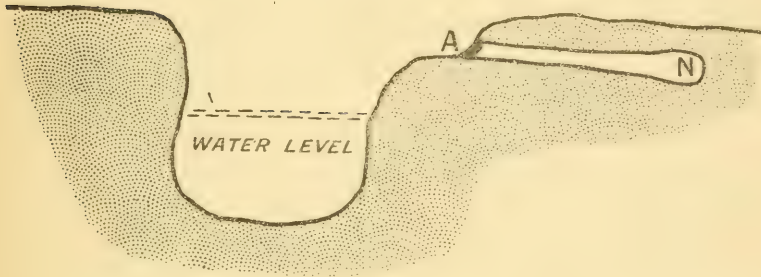


FIG. 41.—SECTION OF CLOSED STOP AT SIDE OF MARSH DYKE.
(Length, 4 or 5 feet.)

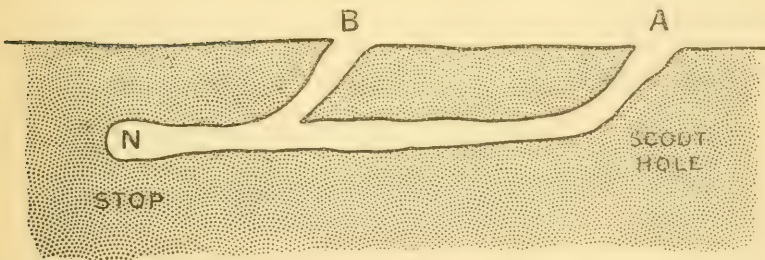


FIG. 42.—SECTION OF STOP ENLARGED BY A SOLITARY OLD RABBIT, and scout- or bolt-hole added at A. B is the original entrance.

(No. 42 is after Owen Jones and Marcus Woodward, *Woodcraft*, 1910, 92.)

The above are diagrammatic, and N is the sleeping compartment or nursery, A and B the entrances.

Figs. drawn by M. B.-H.

developed, and the stops are sometimes placed so near a main burrow that every member of the colony must know of its existence, especially on rocky ground where the noise attending excavation must be considerable.

Few naturalists seem to have seen a doe at work closing her nursery, and there has recently been some discussion¹ as to exactly what method she employs. Daniel² and William Bingley³ stated that the burrow is closed "by means of her hinder parts"; Sir Harry Johnston, that the mother digs with her fore and flings backwards with her hind feet; but it was left to Mr C. J. Davis⁴ to describe the efforts of a domestic rabbit to close the entrance of her nesting-box. This she did by flinging sawdust against it through her widespread hind legs, which, be it noted, is the manner of digging in dogs. There is probably a good deal of variation in method, but none of those mentioned above would explain the firm and deliberately careful manner in which the hole is usually closed.⁵ It seems likely that the most correct account is that of Mr Hugh Wormald,⁶ written from observation of a domesticated wild rabbit. This doe used to turn her back to the nursery compartment of her hutch, and (with her fore feet) scrape all the available grass, sand, and earth into a pile in front of the hole; she then pushed the collected material into the aperture with her fore feet until she had the hole closed. At first she kept the young completely blocked in all day and only visited them by night. When they could see and run a little she used to open the hole in the evenings and let them out one at a time to suckle, after which she blocked them in again. When they grew bigger the doe would go to the open door of the nursery, stamp and give a squeaking grunt, when all the young would run to her to be fed.

A somewhat similar description is that of Mr J. P. Nunn,⁷ who wrote of two does of the lop-eared domestic breed that, having first scraped the earth up into little heaps, they arched their backs, whereby they got their hind feet nearly up to the heaps;

¹ Initiated by the late Henry Scherren, *Field*, 27th November 1909, 975.

² *Op. cit.*, i., 488.

³ P. 316.

⁴ *Field*, 4th December 1909, 1049.

⁵ As shown by the fact that in wet weather the soil moved by a doe rabbit becomes worked into lumps (Jones).

⁶ *Field*, 4th December 1909, 1049.

⁷ *Journ. cit.*, 7th March 1908, 410.

histories of very many others, which were formerly little known, have been fully elucidated, while, speaking generally, an immense increase in our knowledge on such important subjects as Migration, Distribution, Habits, Nidification, Plumages, has accrued: And lastly, a new and important branch of study has been instituted—namely, the recognition of the various Racial Forms or Sub-species exhibited by certain birds in the British Islands, on the Continent, and elsewhere.

A great advance has also been made towards a more satisfactory system of classification of the Aves—always a difficult subject—and this necessitates departures from the older views.

To bring this Standard Work thoroughly abreast of the most recent knowledge in all these departments is the object of the present work.

It should be remarked that while it is not intended to go fully into Synonymy, yet, where changes of nomenclature have been necessary in order to conform with the Law of Priority—the only method by which complete uniformity in nomenclature can ultimately be attained—the names used in the Fourth Edition of Yarrell's "British Birds" and in Saunders' "Manual," and the Trinomial Names of the British Racial Forms, and of those occurring in Britain as visitors from the Continent, will be quoted, as will also the Original Name under which the species was described.

In requesting Mr Eagle Clarke to undertake the duties of Editorship, the Publishers desire to make it known that they are acting under the advice of the late Mr Howard Saunders, who placed all his collected notes for a New Edition at Mr Eagle Clarke's disposal for this purpose. That Mr Eagle Clarke is eminently fitted for the work is well known to all who are interested in ornithological science. Through his investigations of the subject, and contributions to its literature, he has long been recognised as one of the foremost authorities on all that relates to British birds. He has studied our native birds in many portions of the British Islands, and has visited a number of bird-haunts in various parts of Europe in order to become acquainted in their Continental homes with the visitants that seek our shores.

On the important matter of the Migrations performed by British Birds, Mr Eagle Clarke's knowledge is unrivalled—a material fact, when it is called to mind how little has been said on this most important subject in any published History of British Birds.

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STUDIES IN BIRD-MIGRATION

BY WILLIAM EAGLE CLARKE, F.R.S.E., F.L.S.

Member of the British Association Committee on the Migration of Birds as
Observed on the British and Irish Coasts, and Author of its Final
Reports, 1896-1903, etc.

With Numerous Illustrations and Maps

WITH the exception of the two initial chapters, this work is entirely original, being the result of the author's investigations and personal experiences. These have extended over many years, during which exceptional opportunities have been enjoyed for acquiring knowledge on Bird-migration generally, and its British aspects in particular.

In 1884 Mr Eagle Clarke was elected a member of the British Association Committee on the Migration of Birds as observed on the British Coasts; and on the completion of that great enquiry, he was requested by his colleagues to prepare the final reports on the results obtained—a difficult and arduous task, which he accomplished in 1903.

During the preparation of these reports (five in number), Mr Eagle Clarke became much impressed with the advantages which were likely to accrue from placing a trained ornithologist at a number of the most favourably situated observing-stations around our coasts. If this could be done, he believed that some of the difficulties which the phenomena presented might be solved, and our knowledge regarding the subject generally considerably advanced.

This conviction led him to undertake, by the special permission of the Elder Brethren of the Trinity House and the Commissioners of Northern Lighthouses, a series of personal investigations at various light-stations, each of which was selected for a special purpose. In all, Mr Eagle Clarke has resided no fewer than forty-two weeks in these isolated and remote observatories; the stations visited being the Eddystone Lighthouse, the Kentish Knock Lightship (33 miles off the Essex coast), the lighthouses on the Flannan Isles and Suleskerry (both lying far out in the Atlantic), and the lighthouse at Fair Isle (the "British Heligoland"). He also visited the Island of Ushant—an important station—and Alderney for similar purposes; and spent a month or more in the autumn of 1910 at St Kilda, for the purpose of carrying the investigations to the outmost fringe of the British area.

With these unrivalled experiences for its foundations, the book should not only prove a valuable contribution to the subject of Bird-Migration, but should occupy a place essentially its own in ornithological literature.

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BY

GERALD E. H. BARRETT-HAMILTON

B.A. (CANTAB.), M.R.I.A., F.Z.S.

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FIFTY SMALLER ILLUSTRATIONS

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1912

A NEW AND REVISED EDITION OF
YARRELL, NEWTON, AND SAUNDERS'

HISTORY OF BRITISH BIRDS

EDITED BY

WILLIAM EAGLE CLARKE, F.R.S.E., F.L.S.

Keeper of the Natural History Department, The Royal Scottish Museum; Member of the British Association Committee on the Migration of Birds as Observed on the British and Irish Coasts; Corresponding Fellow of the American Ornithologists' Union; Corresponding Member of the Ornithologischen Vereins in Wien; Membre Honoraire du Bureau Central Ornithologique Hongrois; Member of the British Ornithologists' Union, etc.

ILLUSTRATED BY ORIGINAL COLOURED PLATES OF EACH SPECIES
SPECIALLY EXECUTED BY WILLIAM PENNIE

MISS LILIAN MEDLAND

THE publication of Yarrell's "History of British Birds" was commenced in 1837 and completed in 1843. Its outstanding merits were at once recognised, and a Second Edition was called for in 1845, followed by a third in 1856.

From the issue of the Original Edition down to the present day, Yarrell's "History of British Birds" has generally and deservedly been regarded as the standard authority on British ornithology.

In the year 1871 a Fourth Edition was begun, under the masterly editorship of Professor Newton—the greatest British ornithologist of all time. Unfortunately Professor Newton's official engagements at the University of Cambridge only allowed him to complete the first two volumes; and in 1882 Mr Howard Saunders was selected to edit the remaining volumes, a task which he successfully accomplished to the entire satisfaction of ornithologists in 1885.

The many excellences of this last edition advanced the work more than ever in the public and in scientific favour. To its stimulating influence is to be mainly attributed the marvellous and unprecedented activity which has resulted in those extraordinary advances made in all branches of British ornithology during recent years—advances which have rendered it essential that a new work based upon this classical and comprehensive foundation should be issued.

During the period alluded to, a considerable number of new and interesting species have been added to our avifauna. The

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RODENTIA (Rodents)—

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The Rabbit or Cony 217

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Group Eulagos 249

The Common or Brown Hare 250

The English local names have been revised in part by Mr W. W. Skeat, M.A. (assisted by Professor W. W. Skeat), and in part by Mr C. M. Drennan, M.A. Lond., late Scholar Emm. Coll. Camb.; the Celtic and Gaelic names by Dr E. S. Quiggin, M.A., Ph.D., Fellow and Lecturer in Modern Languages and Celtic of Gonville and Caius College, Cambridge; while a list of Scottish Gaelic names have been supplied by Mr C. H. Alston. Valuable assistance has been rendered by Mr M. A. C. Hinton regarding extinct Mammals.

ILLUSTRATIONS

FULL-PAGE (*Black and White*).

Scottish Blue Hare.

Head of British Brown Hare (*Lepus europæus occidentalis*), Female.

Spoor of Irish Hare: (1) left fore; (2) right fore; (3) right hind; (4) right hind, sinking deeper in softer mud. (Natural size.)

Head of Irish Hare (*Lepus hibernicus*), Male.

FIGURES IN TEXT.

Spoor of Rabbit in Snow. (*From a Sketch by L. E. Adams.*)

Skulls of: (1) *Lepus europæus*; (2) *L. timidus scoticus*; (3) *Oryctolagus cuniculus*. (All life size.)

Skulls of: (1) *Lepus europæus*; (2) *Oryctolagus cuniculus*; and (3) Palate of *Lepus timidus scoticus* (all viewed from beneath, and $1\frac{1}{4}$ times natural size). (4) Mandible of *Lepus*.

Cheek-Teeth of *Lepus*, diagrammatic and magnified.

Side view of Skull of *Lepus europæus*. (Life size.)

then, by placing their front feet against the heaps, they pressed them forward as far as their bodies would reach or allow, and by repeating this simple operation closed the burrow.

Occasionally, from one cause or another, the young are laid like leverets in a "form" above ground.¹ In August 1904 I found four young rabbits thus deposited. Their eyes had not opened, so they were less than ten days old; yet they were shy and cross, and grunted out their strong displeasure at being handled. Another remarkable exception to the general rule was related by Mr L. Hardy, who stated that five young rabbits were found inside an old scarecrow near Oakham;² and Mr Jones writes me that he has known of them having been dropped on a rick or under a heap of straw.

The Rabbit is a careful mother, but sometimes when her young are examined she is so frightened that she never returns to them. At other times she does not appear to object to interference, if the nursery is not too much disturbed. Occasionally prudence makes her alter the position of her young in the stop, sometimes increasing its length,³ or she will remove them in her mouth to a place of greater safety. There is a charming picture by Mr G. E. Lodge of a doe thus engaged, in Mr Harting's book on the Rabbit.⁴ Timid though she may naturally be, she has been known to attack and defeat a carrion crow, a weasel, and even the much more formidable stoat in defence of her young.⁵ A pleasing account of rescue was told by Mr T. D. White,⁶ who saw a rabbit pursue a stoat as it ran away with a young one in its mouth. Three times the rabbit, turning suddenly, kicked the stoat with its hind feet and sent it flying ten or fifteen yards down the hillside. Eventually it recaptured the (probably dead) young one and carried it back to the burrow from which it had been abstracted. The hind

¹ As in gorse in the Isle of Man (Kermode); and, for other instances, see W. W. Southam, *Field*, 2nd December 1876, 656, and Harting, *Zoologist*, 1877, 18 (same instance); John Cordeaux, *Field*, 9th December 1876, 692; A. C. Spence, *Zoologist*, 1894, 458; D. Coles, *Field*, 7th October 1899, 580; R. Service, *Ann. Scott. Nat. Hist.*, 1904, 66; J. M. Bolton, *Field*, 12th September 1908, 514; A. J. Steel, *Field*, 21st August 1909, 377; William Evans.

² *Field*, 16th December 1876, 726.

³ Kearton, *With Nature and a Camera*, 1898, 180.

⁴ *Op. cit.*, 20.

⁵ See Harting, *op. cit.*, 19-21; and there are numerous other records.

⁶ *Field*, 4th September 1897, 393.

legs are the regular weapons of attack in fights between rabbits, the combatants bounding over each other like fighting cocks; but they also employ their incisor teeth and the strong claws of their fore feet; and both tame and wild individuals, if frightened or suspicious, will sometimes bite in defence of their young, or even occasionally¹ otherwise. As a rule, however, they seem to be unaware of their undoubted power in this respect, perhaps on account of the overpowering fright from which the poor things suffer when captured. The old bucks bite each other a good deal when fighting, as their ears are frequently torn, and the wounds look as if made by their teeth. At the commencement of a battle they lay the ears back like an angry horse, but afterwards as they bound and kick they keep them erect or move them much about.²

As soon as the young are old enough to wander, the nesting burrow is deserted (about the 21st day at Kilmanock), and mother and offspring go their own ways, taking up their abode elsewhere. If suitable burrows are available close at hand they do not wander far,³ and at Kilmanock a yellow individual has been noticed for more than a year living near the place of its birth. The old bucks are probably solitary except when breeding,⁴ and are occasionally found occupying disused stops after the young have left them, but in this case a scout-hole is often added to the original stop. Mr Millais's⁵ suggestion that the nesting-burrow may be enlarged and other new ones constructed around it, until it may itself become the nucleus of a small warren, may be true occasionally, but does not appear to represent the normal procedure.

Rabbits seem to be constantly practising at digging, and their wanton horseshoe-shaped scratchings, a few inches deep, may be seen in all places which they frequent, and often serve to distinguish damage done by them from the work of hares. According to Colonel Butler,⁶ these abortive scratchings are

¹ Simpson, *op. cit.*, 23; Jones, *Woodcraft*, 96. I have known young bunnies in the nest to bite sharply when handled and teased on the day before they left it finally.

² See Charles Darwin, *The Expression of the Emotions in Man and Animals*, chap. iv.

³ Excluding occasional, but often very marked, exceptions.

⁴ There is a good account of the life of rabbits in George Abbey's *The Balance of Nature*, 1909, 227.

⁵ iii., 47.

⁶ Quoted by Millais, iii., 50.

invariably the work of bucks, which are naturally more restless than the does ; but corroborative evidence on this point would be welcome.

Apart from instances either abnormal or based on maternal feelings, as given above, the idea of resistance to a carnivorous animal seems never to enter the animal's head. In fact, a hunted rabbit will sometimes lie down screaming, as if prevented by its fear from further attempts to escape.¹ Mr Millais² comments on the indifference which rabbits may display to the presence of a stoat, especially in open fields where a large company is feeding. He writes that he has twice seen a stoat pass through a number of feeding rabbits without their doing more than just lollop out of the way ; but his sketch of the actions of rabbits that had been actually mauled by a stoat has met with some criticism as being imaginative.

Although not gifted with exceptional intelligence, rabbits are, nevertheless, clever enough for all the ordinary purposes of their existence, and occasionally they seem to rise higher in the scale of common sense and to almost attain to concerted action. Miss Haviland has sent me an instance of this. A patch of buckthorn bushes having been frequently beaten with dogs and the rabbits driven out and shot, the survivors suddenly discovered that they could escape by running out of the cover the moment the dogs entered it, which they accordingly made an invariable practice of doing whenever a party came to shoot.

In the articles on the hares a good deal will be found about the speed of those animals. It is also necessary to say something about the rabbit's powers of running. The numerous steps which the comparatively short legs of the animal compel it to take when going at its best speed are certainly very suggestive of pace ; and although very inferior to a hare, it cannot be called deficient in this quality, as I have several times seen one by its dodging elude a smart pair of greyhounds for three or four turns. Apart from pace, the difference between a hare and a rabbit is that the latter has no wind, and, unless it gets clear away at the start, its race before dogs is invariably finished after a few twists or turns,

¹ Owen Jones has written a graphic account of the chase and capture of a rabbit by a stoat in *A Gamekeeper's Notebook*, 1910, 237.

² iii., 49.

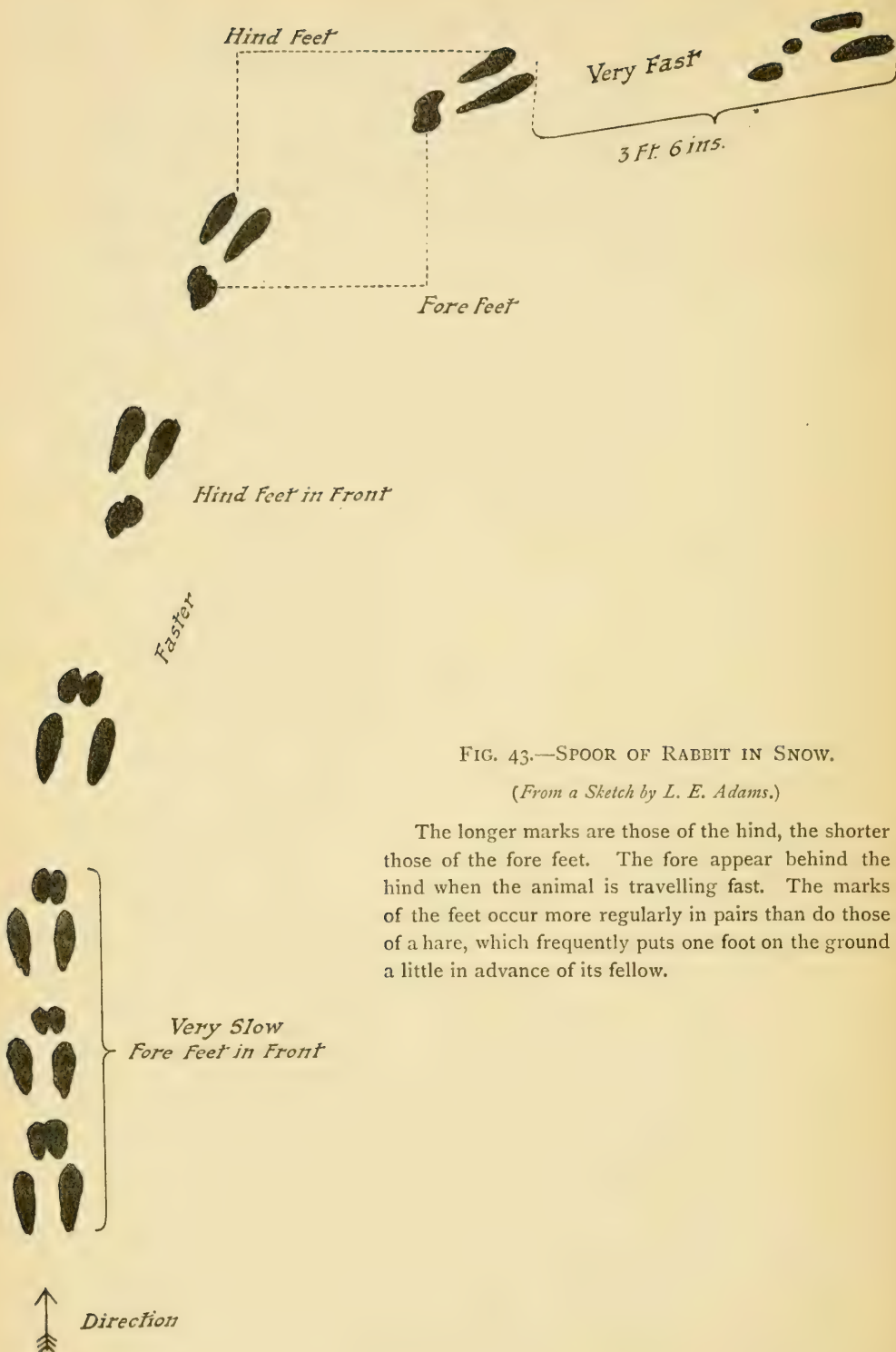


FIG. 43.—SPOOR OF RABBIT IN SNOW.

(From a Sketch by L. E. Adams.)

The longer marks are those of the hind, the shorter those of the fore feet. The fore appear behind the hind when the animal is travelling fast. The marks of the feet occur more regularly in pairs than do those of a hare, which frequently puts one foot on the ground a little in advance of its fellow.

whereas a good hare is only then settling down into its stride. The rabbit goes off with a fine rush for a few yards, while a hare, on the contrary, reserves her strength. As Mr Allan Gordon Cameron has remarked,¹ a rabbit gets up its top speed at once, and has no spurt at a pinch, whereas a hare requires pressing, will not otherwise get properly extended, and answers splendidly to every effort of the dogs that may be almost touching it. In temperament, in fact, the two animals are widely different. The hare, confident and having no thought for a snug burrow at the end of her run, deliberately looks for her salvation to the length of the course, and is never beaten until she is in the enemy's mouth. The rabbit, designing only to effect an expeditious retreat to its burrow, loses heart if its efforts are not crowned with immediate success. If cut off from home and sorely pressed, it sometimes becomes paralysed with fear, and yields its life without further endeavour. Another point of difference is that a hare, owing to its superior size and longer stride, cares little for the nature of the ground on which it runs, and, indeed, sometimes when the going is unsuitable to greyhounds, its furry feet render it invincible. A rabbit, owing to its short legs, must have fairly good ground to run on if it is to make its best efforts. It is a poor performer across furrows, and in thick tussocky grass I have myself run down and caught one without the assistance of dogs.

Similarly, rabbits suffer a great deal when there are heavy falls of snow, the presence of which is very harmful to them. Their short legs are of little use in carrying them over the soft surface, and if they venture abroad they are easily caught. If no thaw comes in a very few days, they become emaciated, and may ultimately die, after having been reduced to feeding on the bark of trees and shrubs.

The spoor of a rabbit will be recognised from the annexed figure without further description. It resembles that of a hare, but is smaller, and the marks of the four feet at each hop fall nearer together.

The "paralysis of fear," mentioned above, may have some connection with the crouching of an outlying individual in its form until a deft kick hurls it forth into a rush for

¹ *Field*, 30th November 1895, 895.

home which appears all the more vigorous by contrast with the previous inactivity. According to Mr Graham,¹ a rabbit, if alarmed on bare ground, and fearing an obstacle in the way of its homeward flight, "stretches out his legs, and lies as motionless as if he were dead"; but I have not observed this trait. Rabbits are also described as "feigning death,"² but that also must be the same "paralysis" in another shape, since it manifestly cannot be an advantage to a highly palatable animal that an enemy should think it dead.³

The comparatively long tail of the Rabbit has been alluded to on pages 194 and 201, when comparing this animal with the hares; and anyone who watches one from behind as it moves about, cannot fail to notice the conspicuous movements of that organ⁴ in what is otherwise an inconspicuous animal. It seems to bob up and down as the animal runs about, as if intended to be a kind of lure. This peculiarity was noticed by Charles Darwin,⁵ who wrote of it with strict accuracy, that:—"The hare on her form is a familiar instance of concealment through colour; yet this principle partly fails in a closely allied species, the rabbit, for when running to its burrow, it is made conspicuous to the sportsman, and no doubt to all beasts of prey, by its upturned white tail." Mr Alfred Russel Wallace goes a step further, believing that the tail is a "signal flag of danger." "When disturbed or alarmed it makes for its burrow, and the white upturned tails of those in front serve as guides and signals to those more remote from home, to the young and the feeble: and thus, each following the one or two before it, all are able with the least possible delay to regain a place of comparative safety."⁶ Mr Wallace's ingenious theory was hailed with much delight, and has given pleasure to many naturalists, field and closet. It has, however, been subjected to a good deal of criticism, for apart entirely from the fact that rabbits probably do not approach each other at all by sight if at any distance, it is

¹ *Op. cit. supra*, 210.

² See J. R. B. Masefield, *Field*, 8th April 1911, 703.

³ J. L. Bonhote tells me that when a rabbit is frightened its heart beats slower, which observation seems to throw light on the "paralysis" question.

⁴ "The bucks carry their tails higher, so that the white shows much more conspicuously when they are moving."—Butler in Millais, iii., 50.

⁵ *The Descent of Man*, ed. ii., 1889, 542.

⁶ *Darwinism, etc.*, ed. ii., 1889, 218.

confronted by the serious objection that the appearance of a rabbit's tail as seen by a man's eyes at a height of about five feet above the ground, must give quite a different impression to that received by another rabbit with its eyes on the side of its head, at a height of about six inches. Further, hares have similar, albeit less conspicuous, tails, yet they separate when alarmed. But there is no evading the fact that the tail is highly conspicuous, and, therefore, consciously or unconsciously, "advertising." It is clearly significant of motion, and hence, probably also of alarm, so that it may well be used as "a signal flag of danger." But that it is also a guide, or that other rabbits follow it, is highly improbable.

Another hypothesis is that of Mr Abbott H. Thayer, who has taken the trouble to view the rabbit's scut from the position of one of the beasts of prey which usually pursue it, and which are nearly all beasts of low stature—that slink and crouch, as he describes them. Seen in this way from below, the white tail becomes, according to him, a sky-matching costume, obliterating the outline of the animal carrying it. The foreshortened body is blotted out against the sky by the brightly displayed white sky-lit stern in a manner illustrated by Mr Gerald H. Thayer's¹ photographs in his father's work. The effect is, according to Mr Thayer, especially at night, to blur the outline of the animal as seen by a carnivore, so that the latter's aim is marred as it leaps at its prey. In cases of complete illusion the hunted beast vanishes into air, as it were, before the carnivore can get its aim for a leap, or even before it can perceive the direction of the quarry's flight. The tail seems, however, not to be carried sufficiently high on the back to comply with the needs of the Thayerian hypothesis, and, indeed, the absurdity of the position taken up by its ingenious author has been amply demonstrated by Mr Theodore Roosevelt.²

¹ *Concealing Coloration in the Animal Kingdom*, 1909, 152-153. It should be remembered that in writing of "rabbits," American zoologists, unless they specially state the contrary, refer to "hares." But this fact does not in this case affect the argument, since everything that applies to the tail of a hare is applicable, and even more so, to that of a rabbit, in which the advertising (or, according to Thayerian interpretation, obliterative qualities) are developed to an extreme extent.

² "Revealing and Concealing Coloration in Birds and Mammals," in *Bull. Amer. Mus. Nat. Hist.*, xxx., art. viii., 119, etc., 23rd August 1911; noticed by J. A. Allen, *The Auk*, xxviii., 4th October 1911, 472-480.

Neither of the foregoing hypotheses takes into account the shortening of the tail which has taken place throughout the whole sub-order of duplicident rodents, and which has, no doubt, been brought about for important structural and physiological reasons. Viewed in this light, the longer tail of the Rabbit seems to be a natural characteristic of an animal less highly specialised than the hares.

Like hares, rabbits can swim, but have fewer opportunities of taking to the water. In an extreme case, a bewildered bunny has been known, in its confusion, to plunge into the sea. Mr Millais has sketched one swimming,¹ and remarks that "The rabbit is the same as the hare . . . the whole of the rump and tail is above water, while the hocks of the hind legs appear above the surface as he takes each fresh stroke." This is not, however, my experience, being rather that the *Leporidæ* swim easily enough, carrying the whole body under water except the head; the ears are laid well back, as in rapid running. The animal gives one an impression that it is trying to hide itself by keeping its body low in the water; and this is undoubtedly the case when it has been long enough immersed to become thoroughly wet. While any of its fur remains dry, it swims in the manner indicated by Mr Millais, and the discrepancy is thus explained.

Thoroughly terrestrial on all ordinary occasions, rabbits are sometimes found ascending trees to a height of ten or twelve feet, where the boughs or ivy are thick, or the trunk sloping.² Many such instances have come under notice, and, indeed, the activity of the animal often affords subject for wonder, as when one "runs" up a wall as high as a man's head; and when one escapes from its pursuers by climbing up the ivy on a wall, and jumping clear on the other side. Probably the most striking instance of one "nesting" in a tree is related by Mr G. C. Vassall,³ who was shown a litter of young in a hollow branch at a height of about eight feet from the ground. The

¹ *British Deer and their Horns*, 1897, 44. See also editor, *Field*, 14th May 1898, 712; C. L. Eastlake, also H. J. Grierson, *Field*, 14th January 1899, 62; R. Lydekker, *The Royal Natural History*, 1894, iii., 198; and other references.

² See Harting, *op. cit.*, 27; J. Halifax, *Field*, 28th January, 1899, 134. The rabbits imported into Australia are reported to have acquired the power of tree-climbing.

³ *Field*, 5th June 1909, 983.



existence of nests in hollow trees, several of which were known to Alston,¹ seems to be a corollary of the animal's love of burrowing amongst the roots of trees.

The food of rabbits may be dismissed in a very few words, since, although thriving best on rich pastures, they will eat a large variety of vegetable substances, from leaves to tubers and roots,² and in winter, if more palatable food is scarce, they are very destructive to the bark of most trees. In the hot summer of 1911 my keeper, M. Parle, found their stomachs full of blackberries; and according to Mr Simpson,³ furze, and also acorns, form excellent fodder for them, and he states that they grow very fat if fed on acorns. Rabbits are commonly believed not to drink in the wild state, but Mr Cocks has seen fully a hundred drinking simultaneously at the pond at Swinley, in Windsor Forest, where the soil is dry and sandy. They soon learn to lap milk in captivity, and should always be kept supplied with water when about to kindle.

Only two instances are known to me of wild rabbits deserting their habitual vegetarianism. Thus Mr Adams states⁴ that he has constantly found heaps of gnawed empty snail-shells at the mouths of burrows in the north of Ireland. On the sandhills at Portrush, these heaps often amounted to a bushel, and sometimes nearly blocked up the entrances to the burrows. He never actually observed the animals eating the snails, but concluded that the work could not have been that of rats, and that the molluscs must have been brought in one by one by the rabbits to be eaten at leisure. The truth of Mr Adams's surmise has since been confirmed beyond all doubt by Mr C. E. Wright,⁵ who was able to watch rabbits eating snails in County Donegal.

When food is plentiful near their burrows, rabbits do not stray far away, and their life is one of more or less regular routine. They feed for the most part during the afternoon,⁶

¹ *Bell*, ed. ii., 345.

² W. P. Westell (*The Young Naturalist*, 1909, 114) suggests that in spring rabbits nip off portions of the flowers of primroses in the woods out of sheer mischief.

³ *Op. cit.*, 73; *Field*, 9th December 1893, 896.

⁴ *Quart. Journ. Conchology*, vol. xii., 268, April 1909.

⁵ *Journ. et loc. cit.*

⁶ Arthur Willey (*Convergence in Evolution*, 1911, 29) cites the Rabbit as a rare instance of the combination of fossorial and diurnal habits. Very many burrowing mammals are certainly nocturnal, but there are numerous exceptions, as, for instance,

evening, and night,¹ and in the morning rest within the shelter of the burrows, play, or bask in the sun.² In feeding, they at first advance slowly and cautiously from the burrow to the edge of the covert; then, if they have a distance to travel, they break into a rush at the end. Passing over the same ground day after day, they consume the vegetation near them in succession, clearing a space around their burrows and sometimes cropping one side of a field bare, while, perhaps, the remainder of it is untouched. Their depredations on grass or growing corn are thus, unlike those of hares, confined in normal conditions to definite areas. When food is scarce, as when snow lies on the ground, or on poor pastures, they keep on the feed more continuously, and will wander a long way to a turnip field, or to bark trees in a plantation. In the spring, too, the sexual season causes many of them to seek new ground, and the places of those killed off in pleasure-grounds or other forbidden fields are soon filled by newcomers. Occasionally their routine is upset even where food is plentiful, for they are believed to graze voraciously before a storm in summer, and when the grass is wet are not observed so much abroad.

The tastes of rabbits and hares in trees have been somewhat extensively treated by Messrs Simpson and Harting in their respective works, as well as by Mr Abbey,³ who points out that, unlike hares, which always nibble, gnaw, and peel above the snow line, rabbits take up their abode in the "caves" formed by snow overlying evergreens, where they feed on the stems. Miss Haviland has rightly drawn my attention to the fact that in the south-east of Ireland, where the winters are rarely severe, rabbits nevertheless bark trees, and she suggests that the astringent bark of ash, blackthorn, laurel, and ivy are valuable as counteracting the action of the sodden half-decayed grass on which they are driven to exist for so many months of the year. She believes that the roots of the wild iris or yellow flag are eaten for the same purpose. Miss Haviland⁴ has observed that in some

more than one species of "mouse" in Britain, and many burrowers living on open plains, as ground squirrels, prairie dogs, golden "meerkats" (*Cynictis*), and others.

¹ But they may be changed from nocturnal into diurnal feeders by a regular course of disturbance at night—see Jones, *A Gamekeeper's Notebook*, 219.

² Simpson, *op. cit.*, 68-73.

³ *Op. cit.*, 101-102.

⁴ *Op. cit.*, 117.

Irish woods a particular tree is barked by rabbits in such a way as to suggest that their object was other than to seek food.

The white flesh, so distinct from the brown meat of the hares, attracted the attention of Herbert Spencer,¹ who connected the differences between the white and red muscles with the relative activity of the two animals. According to Spencer, birds and mammals show greater endurance along with the darker coloured muscles; and, with the same result, he compared the flesh of old and young animals, veal and beef, lamb and mutton, and the flesh of different parts of the same animal, as the leg- and pectoral-muscles of so many birds, such as turkeys, guinea-fowls, and pheasants.²

The scream of a frightened or wounded rabbit is well known to dwellers in the country. It is pitched so high in the very young as to remind one of the shrill cry of a bat. But there are also some peculiar grunting sounds, some of which have been mentioned above. They are somewhat difficult to express in words, since, although distinctly grunts, there is a just perceptible element of shrillness in them. A buck in the spring will approach another rabbit, stamping its hind feet at intervals; as it gets nearer, it begins to grunt frequently and very audibly, and eventually one, generally the second rabbit, retreats, and is chased by the other. In a note by an anonymous writer,³ the grunts are said to be the common property of both tame and wild rabbits, and the action is likened to a hiccough, or to the word "huck" in the throat, without moving the lips; the flanks alone move. The grunt, which is a sound of pleasure, may be rapidly repeated; it may be "a single enquiring grunt" or "a single long-drawn sighing grunt." The latter is accompanied by an impatient stamp of the hind feet, a characteristic method of expressing the feelings that seems to be a useful supplement to the grunts, especially in the resonant burrows. Anger is expressed by a low growl. The writer quoted believes the grunt to be confined to adults, but it has been

¹ *Principles of Biology*, revised edition, 1889 (vol. ii.), 365

² Spencer's generalisation will not stand examination. Dark-fleshed birds, like the ptarmigans of Spitzbergen and Alaska, are very inactive—much more so than the pheasant and partridge, which are, the former partially, the latter wholly, white-fleshed.

³ B. P., *Field*, 11th March 1905, 414, a note which must be quoted, although anonymous, in default of a better.

shown on p. 217 that this is not correct. Anyhow, rabbits, especially bucks, can be called and shot by a sound similar to that used for calling hares, and the Scots have a special name, "map," for a rabbit-call;¹ indeed, calling rabbits in order to shoot them is a common practice, but it is difficult to decide what is the motive of the called rabbit—curiosity, sociability, or anger. A rabbit, like many small birds, will approach, usually with many stamps, to investigate a very clumsy calling that has no effect on hares other than to make them shake their ears and remain still listening, and Mr Cocks has known one to reconnoitre him in this way on a dark night in a wood.

The greater attractiveness of one or other of the domestic breeds of rabbits is such that few people take the trouble to tame a wild one. But the latter, although, if adult, rarely losing its "wildness" after capture, will, if taken young, well repay the attention bestowed on it, and more than one thus brought up by hand has lived for years in honour and happiness. At least two such are said to have been alive and well in their eleventh year, another reached upwards of thirteen,² and there are records of others which lived for long periods. Like hares, they are, if left at large in a house, boisterous, noisy creatures, and too active and playful to become altogether satisfactory pets.

Domesticated rabbits are often turned out in coverts "to improve the breed" of the wild ones, especially in regard to size. This result is obtained at the expense of much of the alert liveliness of the true wild animal, but the most conspicuous effect is usually the appearance of a number of abnormally coloured individuals. Miss Haviland has noted that where such varieties are white they do not seem to be killed off by foxes, as might be expected from their conspicuousness, and she suggests that foxes may be frightened by their unusual colour.

¹ See above, p. 180.

² One lived at least six years, Blanche H. Cripps, *Field*, 16th July 1892, 85; eleven years, H. A. Macpherson, *Zoologist*, 1883, 173; one born 1887, alive 10th January 1898, *vide* F. Moekler, *in lit.*, to Oldfield Thomas; white buck, upwards of thirteen years, J. W. M. Dagnall, *Field*, 26th November 1887, 822.

GENUS LEPUS.

1758. LEPUS, Carolus Linnæus, *Systema Naturæ*, x., 57; xii., 77, 1766 (part); based on *L. timidus* of Linnæus—type (see Thomas, *Proc. Zool. Soc.*, London, 1911, 145, published March 1911), and *L. cuniculus* of Linnæus, both from Europe, *L. capensis* of Linnæus from the Cape of Good Hope, and *L. brasiliensis* of Linnæus from Brazil.
1829. CHIONABATES, Jakob Kaup, *Europäische Thierwelt*, i., 170; based on *variabilis* and *borealis*.
1867. EULAGOS, J. E. Gray, *Ann. and Mag. Nat. Hist.*, September, 222; based on *Lepus mediterraneus* of Wagner, and *Eulagos judeæ* of Gray, "The Holy Land Buneas, Tristram."
1899. EULEPUS, Alex. Acloque, *Faune de France, Mammifères*, 52; based on *europæus* and *variabilis*.
1904. PÆCIILOLAGUS (sub-genus), M. W. Lyon, jr., *Smithsonian Misc. Collections*, 395, 15th June; based on *Lepus americanus* of Erxleben, *L. bishopi* of Allen, *L. klamathensis* of Merriam, *L. saliens* of Osgood, and *L. washingtonii* of Baird.

The **synonymy** is simple.

Hares are probably of American **origin**, since they appear first in the upper Oligocene of North America. In Europe and Asia they are not known earlier than the lower Pliocene.

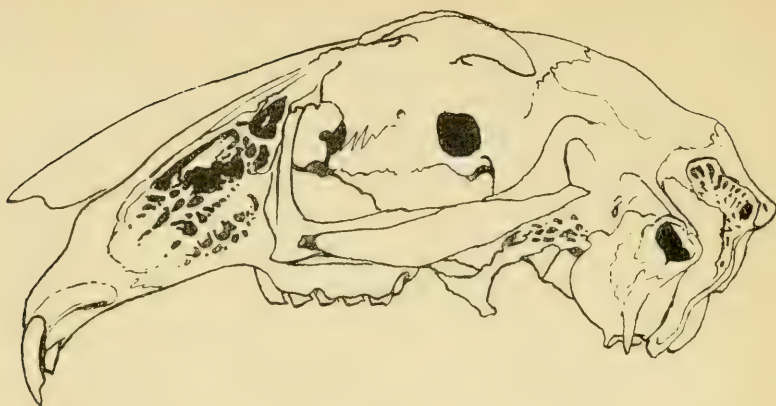
They are widely **distributed** in North America, Asia, and Africa in tropical, temperate, and arctic regions.

They form a very natural assemblage of leporide rodents, which rest in "forms" in grass or bushes and do not usually burrow. In escaping from their numerous enemies they rely on their speed and activity, or their power to shake off their pursuers by resorting to thick coverts. Even when partially gregarious or sociable in their feeding habits, as they sometimes are, they separate if chased, and rejoin each other by means of their very efficient olfactory apparatus, no doubt helped by the secretions of their inguinal glands.

The **young** are born in a high state of development, fully haired, and with their eyes open.

The **flesh** of adults cooks dark and resembles venison; it is much lighter in leverets.

Characters:—Hares have the **body** light; the head thick; the ears long; the eyes large, prominent, placed on the sides of the head and with slightly elliptical pupils; the insides of the cheeks hairy; the nostrils circular, and connected by a fold with the cleft upper lip. The slender limbs are of uneven



(1)



(2)



(3)

FIG. 44.—SKULLS OF (1) *Lepus europæus*; (2) *L. timidus scoticus*; (3) *Oryctolagus cuniculus*.
(All life size.)

length, the hinder being conspicuously large and strong, and with four digits ; the shorter fore limbs have five. The tail is always present, but is short and recurved. The soft fur is, as described above (p. 162), composed of three kinds of hairs ; it is so dense on the soles of the feet as almost to hide the claws.

The intestine is long, with a large cæcum.

The **skull** is strongly arched, and distinguishable from that of other allied genera by its breadth, which shows itself specially in the brain-case, rostrum, and nasals, the two latter being also short. There are no alisphenoid canals.

The superciliary processes of the frontals are well developed as large, wide, triangular structures, with one angle attached to the skull, and the other two usually quite free. They stand out from the side of the head, and are considerably arched from before backwards. Between the free angles and the skull there are usually large notches, the posterior being the larger ; but occasionally an angle may be so directed inwards that its apex meets the frontal bone and forms a foramen instead of a notch.

The interparietal bone, although present in the very young, becomes obliterated in the adult (see Fig. 33, p. 174).

The bony palate is short, and reduced to a mere narrow bridge with its transverse breadth greater than its least antero-posterior length ; the length is distinctly less than the width of either the posterior nares or the coalesced incisive foramina, both of which form wide apertures. About four-fifths of the palatal bridge are formed by the maxillaries, and only one-fifth by the palatine bones.

The sides of the maxillary bones are fenestrated.

The zygomatic arches are well developed, deep but thin, and are thickened anteriorly so as to form massive buttresses projecting at right angles from the maxillary walls. Each is composed chiefly of the malar bone, which, however, fuses at an early age with a small zygomatic process of its maxilla, of which it afterwards has the appearance of being a long backwardly directed process, with its extremity projecting behind and below the zygomatic process of the squamosal. The latter is a triangular, foot-like structure carried on a narrow stalk ; it articulates with the malar by means of a suture, which persists through life, and is only about half the length of the

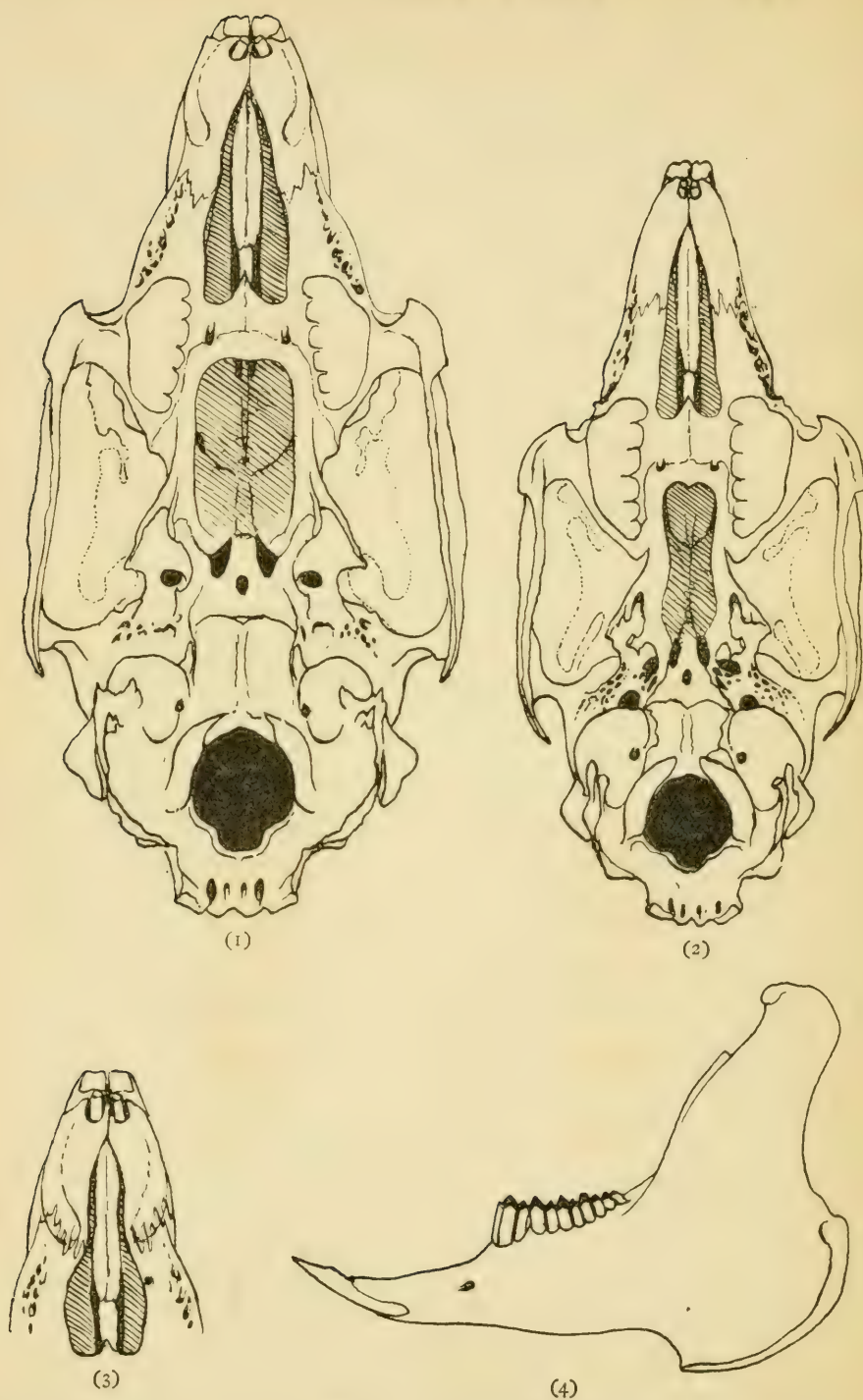


FIG. 45.—SKULLS OF (1) *Lepus europæus*; (2) *Oryctolagus cuniculus*; and (3) PALATE OF *Lepus timidus scoticus* (all viewed from beneath, and $1\frac{1}{2}$ times natural size). (4) MANDIBLE OF *Lepus*.

superior border of the malar, when the latter is measured from the anterior end of the squamoso-malar suture to the antero-inferior angle of the orbit.

The external auditory meati are prolonged upwards and backwards into tubular structures, which, combined with the bullæ, resemble flasks.

The angular and condyloid processes of the mandibles are much developed; the coronoid processes nearly absent. The mental foramina are small, and lie well in front of the cheek-teeth.

There are thirty **teeth** at birth; soon afterwards a pair of upper incisors is lost, and a little later the three anterior upper and the two anterior lower cheek-teeth are shed and are replaced by their permanent successors. Thus the adult dentition comprises twenty-eight teeth, of which the arrangement is—

$$i \frac{2-2}{1-1}, \quad c \frac{0}{0}, \quad pm \frac{3-3}{2-2}, \quad m \frac{3-3}{3-3} = 28.$$

The large upper incisors have each a groove, often filled with cement, running vertically along their anterior surfaces. (Fig. 34, p. 175.) The courses of their roots are plainly visible externally.

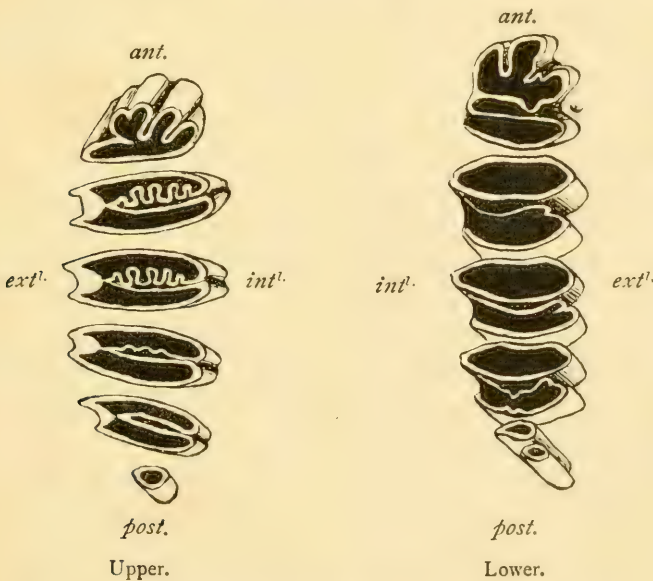


FIG. 46.—CHEEK-TEETH OF *Lepus*, diagrammatic and magnified.

The permanent cheek-teeth are without roots, so that they grow throughout life. They have the appearance of cylinders,

not circular, but broadest transversely, and filled with dentine. The first upper premolar has on its anterior face at least three enamel, cement-filled foldings, of which the central one is deep, the two outer shallower. The second, third, fourth, and fifth teeth have each, on the inner side, a single deep re-entrant enamel fold, extending about three-quarters of the distance across the tooth; its sides are nearly in contact, and more or less crenated. The enamel lines the sides of the transverse folds, and completely invests the internal faces of the teeth; externally it has atrophied, so that the outer faces of the teeth are formed in great measure of bare dentine. For an account of the evolution of this structure, see above, under *Ochotonidæ*, pp. 156-158. The last upper molar is a small, greatly reduced tooth, elliptical in section and quite simple in structure.

The lower cheek-teeth are framed on the same plan as the upper, but in these the enamel is infolded to a much greater extent, so that they are divided into two portions, an anterior and a posterior, by a single transverse fold from the outer side. In accordance also with the well-known principle, that the inner side of an upper corresponds with the outer side of a lower grinder, and *vice versâ*, the enamel is developed continuously on the outer, and atrophies on the inner sides. The anterior portion of the first grinder (*pm* 3) has a small re-entrant angle on its anterior face, and a broader one on its outer side. The second, third, and fourth have their posterior portions with lateral diameters about four-fifths of those of the anterior portions. The last is small, and resembles a double cylinder with a larger elliptical anterior and a smaller separate rotund posterior portion.

The mandibular tooth-rows lie so much closer to each other than those of the maxillaries that only the teeth of one side are capable of opposition at the same time, and the jaws have consequently a lateral motion in mastication.

In the **skeleton** the cervical vertebræ are uniformly lengthened, the transverse processes do not project laterally from their centra to a marked extent, and the anterior and posterior spines are comparatively elongated.

The lumbar vertebræ have wide and long transverse processes with expanded extremities, which arise abruptly from the anterior half of their centrum. Those of the fifth are the

longest of the series ; and each has a length equal to that of its centrum, plus half the length of the centrum just anterior to it.

There are thirteen to fourteen caudal vertebræ.

The ribs have the spine-like portions of the tubercles well developed, the last pair bearing these tubercles being the eighth. The second, third, fourth, fifth, and sixth pairs have the ventral halves of their shafts very flat and broad, so that the greatest width of one of these ribs, just behind the tubercle, is very much less than the width of the shaft in its lower portion. Seven pairs of ribs articulate with the sternum. The sterno-costal cartilages are very short and wide as compared with those of *Oryctolagus*.

The clavicles are imperfect, as throughout the family (see above, p. 159).

The scapulæ are relatively broad with their superior borders relatively convex, the antero-superior angles relatively rounded, and the supra-spinous fossæ relatively broad.

The ulnæ are reduced in size along the centres of their shafts, and, except at their lower extremities, lie almost entirely behind the radii, which latter are rather long and slender, and in length may equal or exceed their humeri.

The fibulæ are ankylosed to the tibiæ.

In some exotic species the lengthening of the external ears has been carried to such an extraordinary degree as to have inspired the belief that these organs could not have been developed solely for purposes of hearing. So good a field naturalist as Thompson Seton can imagine no better use for them, in the North American *Lepus campestris*, than as a possible shelter to the back of the animal as it sits in its form during heavy rains ; and, more than two thousand years ago, the celebrated Greek soldier and sportsman Xenophon (born about B.C. 430), in a treatise on hare-hunting entitled *Cynegeticus*, supposed that, since the tail is so short as to be useless for steering purposes at high speed, an ear on one side might be laid down and thus assist in turning the body when sharply pursued. Modern coursers have also noticed this movement, and say that a hare when coursed and hard pressed by greyhounds, turns down the ear on the side to which she is going to turn, and that she does this in order the better to catch the sound of her

closest pursuer, so that she may turn away from him, for she rarely turns so as to favour the dog that is not leading.

If Xenophon's supposition were correct, it might be argued that the long ears are correlated with the short tail, now so much reduced as to be useless for steering purposes. Winge has, however, suggested (*Jordfundne og nulevende Gnavere*, 1888, 112) that the correlation is between the tail and the legs. As in the fast ungulates, so in *Lepus*, the limbs have become so powerful and so completely specialised for purposes of speed that they have taken over the whole business of steering in addition to that of supporting the body. The tail has accordingly no work left to do, and it consequently tends to disappear. It is superfluous as a counterpoise, and, as it is not required as a fly-flapper, it becomes reduced to a mere stump, and the body itself acts as its own steering organ, through the strong flexor and extensor muscles of the modified vertebral column acting on the extended or flexed body.

In any case, the short scut would seem to be almost a necessity for animals which are being constantly chased, since a long tail would place them more readily at the mercy of their pursuers. Short as is the scut, I have seen a greyhound "chop" it off an Irish Hare which itself escaped for the moment.

Apart from any other considerations, extremely long ears undoubtedly indicate acute powers of hearing, probably in compensation for comparatively indifferent sight, and they point also to their possessors being of nocturnal habits.

Droppings :—These are similar to those of *Oryctolagus*, but larger, and their greatest diameter may reach about 20 mm. They are somewhat flattened pellets of very uneven diameter, dry in texture, dark in colour, and having a strong characteristic odour.

Hybridism :—For many years field naturalists and sportsmen have from time to time reported the occurrence of hybrids between *L. europæus* and *L. timidus*, but until exact methods of studying animals became adopted of late years, all such statements were looked upon with suspicion by workers in museums, who, in fact, were not at the time aware of any accurate mode of distinguishing the hybrids. Latterly, the



HEAD OF BRITISH BROWN HARE (*Lepus europaeus occidentalis*), Female.



characters of the two animals, both external and internal, have become known with so much greater precision that a reputed hybrid receives a more satisfactory examination than was possible until quite recent years. But at the best it must be confessed that such specimens, as might be expected, are extremely like one or other of their parents, and are consequently difficult to distinguish. Nevertheless, sceptical as the scientific mind has undoubtedly been in the past, the general attitude must be regarded as having recently undergone considerable change, and has now become one of acquiescence. The frequent introductions by sportsmen of one or other species of hare into the territories of the other (for details of which see the articles on the species), with the repeated assertions of competent field naturalists like the late John Cordeaux that such interbreeding occurs (see Cordeaux, *Field*, 23rd September 1876, 362; McNichol and Colquhoun, *Field*, 7th October 1876, 434; Lumsden, *Zoologist*, 1877, 101; Harting, *Proc. Linn. Soc.*, London, 1897, 4, and *Field*, 6th May 1905, 762), and finally, the statement by Lönnberg that in southern Sweden, owing to the introduction of the Brown Hare for sporting purposes, hybrids have become comparatively common, have all largely influenced the change. Such hybrids have also been reported from other European countries, as from Russia by Middendorff, from Switzerland, and from Livonia (see Lönnberg, *Proc. Zool. Soc.*, London, 18th April 1905, 278-87). It is certain that, although the Blue Hare as a species retreats before its larger relative, there is no active antagonism between the individuals of either. Where their ranges overlap the two meet naturally and interbreed, and Millais (iii., 24; also *Field*, 18th February 1911, 330) has killed an equal number of both species in a day's shooting at Murthly, Perthshire, and has often seen them rise from their forms close to one another. According to Millais, after severe winters in Perthshire, such as occurred in 1865, 1881, and 1894, large numbers of Mountain Hares descended to the low moors, and to the moorwoods bordering the rivers Tay and Earn, where they stayed on through several summers until they either were shot or wandered back to their proper habitat. During these visitations they mixed indiscriminately with the Brown Hares, and undoubtedly

several crosses resulted; and Millais states that he himself once shot no fewer than six of the hybrids. In Sweden the actual pairing of the Brown and Blue Hares has been observed by sportsmen, and Lönnerberg has described the resulting hybrids, which are stated to be numerous, and perhaps fertile when interbreeding amongst themselves. They are, however, most plentiful immediately after an introduction of Brown Hares into the territory of the Blue, the first meeting of the two species—the current belief that they are antagonistic notwithstanding—seeming to lead to irregular alliances. As they become accustomed to each other, hybridism decreases.

In spite of what has been written above, most of the specimens reported as hybrids are either large Blue Hares, or Brown Hares in the grey pelage. A few, however, show characters intermediate between the two species, and are, therefore to be regarded as correctly named. There are three such in the British Museum of Natural History, all from Scotland, viz., No. 63.8.23.1, an old skin from Inverness; No. 2.11.28.1, a male from Craigmyle, Aberdeen; and No. 6.12.26.1, a male from Capernoch, Thornhill, Dumfries. In all three the ear is longer than in the Blue Hare, the colour pattern similar to but less distinct than that of the Brown Hare, and the tail short as in the Blue, but with a central black dorsal area as in the Brown. Harvie-Brown has also recently forwarded two specimens, of which the characters, both external and cranial, appear to indicate hybridity.

The much more improbable **interbreeding of hares and rabbits** has been even more frequently reported, especially on the Continent, and the credence which such reports have received may have been due to the inducements offered by the numbers of people who are willing to pay a high price for a "leporide." Although "Leporides" are mentioned by Charles Darwin (*Animals and Plants under Domestication*, 1868, i., 105) in one of his arguments, and actually received the technical name of *Lepus darwinii* from Haeckel (*Hist. de la Création des êtres organisés*, 1874, 131), no proof has yet been advanced that two such naturally antipathetic animals, having such diverse structure, habits, glandular secretions and odours, and such entirely different young, have ever united and produced offspring.

So long as rabbits are commonly kept in captivity for purposes of pleasure or profit, reports of their successful hybridisation with hares will probably continue to be advanced by those who have not sufficiently considered the difficulties of the subject. Zoologists will continue to accept such statements with caution;¹ and field naturalists are unanimous that the animals are naturally antipathetic, and will not even thrive well together on the same ground. This may be, as Woodruffe-Peacocke suggests (*The Cultivation of the Common Hare*, 1905, 11), because rabbits, when in numbers, bully, chase,² and worry hares to death, or, perhaps, because the rabbits eat or taint the food of the more delicately feeding hares, or because the former infect the latter with epidemics to which they are themselves immune. A particularly vicious attack by a rabbit was described by E. T. Booth (*Field*, 6th Oct. 1883, 490); the hare was bitten on the hind quarters and gave vent to repeated screams.

The literature of this subject runs through many languages, and is very voluminous. But, since it proves nothing, it may safely be neglected. Its character may be sufficiently indicated by the following sentence, selected from Simpson (*The Wild Rabbit*, 1908, 82), an otherwise sane writer, to whose work, as stated above on p. 202, indebtedness has been gladly acknowledged:—"The Belgian hare is a hybrid between the hare and the rabbit, and as such has been a puzzle to naturalists, because it is almost the only hybrid that is fertile and can perpetuate its kind."

Hares have been the subject of so many **superstitions** in so many lands, that it would be impossible to mention more than a few of the more striking.

There was a hare-god in Egypt from very early times, dating, with the frog-god, from about B.C. 4000. Although so old, it is rare, but has been figured by Wallis Budge (*Papyrus of Ani*, pls. 12 and 35; see also Lanzone, *Mittologia*, pl. 52).

As with the Mole, an anatomical misinterpretation doubtless

¹ For a long account of Roux's experiments, see Holdsworth, *Zoologist*, 1862, 7923 and 7983. The question was well discussed by Saint Loup, *Rev. Sci. Nat. appliquées*, Paris, Nos. 1 and 2, 1-15, and 49-59, 5th and 20th January 1893.

² Cf. "When they (*i.e.* the hares) be in their heat of love and pass any place where conies be, the most part of them will follow after her as the hounds follow after a bitch or a brache" (*The Master of Game*, ed. 1909, 22).

led to the remarkable idea that the **sex** is frequently **changed**; which may be compared with the "widespread African belief that hyænas are bisexual, being male or female as they choose" (Roosevelt, *African Game Trails*, 1910, 329). This error appears in writers of different periods, and is said to have survived until the end of the eighteenth century.¹ Amongst others, Pliny repeated it, saying that hares are of both sexes, and that the female can bear young without the male; and in the Gwentian code of north-east Wales, supposed to be of the eleventh century, the animals are said, not to be capable of any legal valuation, being in one month male and in another female. It is, therefore, not surprising that in many of the older works the masculine and feminine pronouns are indiscriminately applied to them, as was the practice of William Twici, and also of The Master of Game (see p. 247).

Hares are often regarded as beasts of ill omen, and there is a widespread belief that, if one crosses the path, the journey should be abandoned for that day. This superstition may be traced back at least to the French sporting writer du Fouilloux, who believed that a meeting with either hare or partridge when starting out in the morning to harbour a stag would be to augur a bad day's sport (*La Venerie*, v., 22). Similarly, in some parts of Scotland and Ireland (*e.g.* in Connemara, Browne, *Proc. Roy. Irish Acad.*, v., 1899, 260) the name of the hare must not be uttered in the hearing of fishermen. On the other hand, according to Millais (iii., 21), the Scottish people consider it a lucky thing when a hare starts from the last patch of grain to fall, and the animal is by them regarded as the spirit of the corn. This last portion of the harvest to be cut is called "the hare," and the man who cuts it is said to have "caught the hare." This contradictory mixture of good and evil omens seems to have descended from very ancient times, the animal having been associated with ill-luck amongst the Greeks and Indians, but with fertility of the land amongst the Friesians (Keller, *Die Antike Tierwelt*, 1909, 216).

The cleft upper lip is no doubt responsible for the popular idea that the mother of a child born with a **hare-lip** must have

¹ Cf. Merriam's statement of the American *Lepus bairdii*, that all the males have teats and take part in suckling the young (6th *Ann. Rep. U.S. Geol. Survey*, 1873, 667).



(1)



(2)



(3)



(4)

SPOOR OF IRISH HARE; photographed from single footprints made by wild animals on mud in natural conditions. (1) Left fore; (2) right fore, sinking deeper in softer mud; (3) right hind; (4) right hind, sinking deeper in softer mud; both the impressions of the fore feet show all five toes well spread out to assist in turning. (Natural size.)

recently started a hare, or stepped over its form; the same superstition is prevalent in Norway, where, lest a pregnant woman should see it and like evil consequences result, a hare's nose is always cut off directly it is killed.

The **hare** and domestic **cat** are often associated either by name (as "puss") or in legends, the latter generally not to their credit, since both commonly figure as the servants or companions of witches. E. R. Alston (*Zoologist*, 1867, 921) quoted from Simrock (*Handbuch der deutschen Mythologie*, 1855, 488), to show that the saying "letting the cat out of the bag" is connected with the German superstition that you may obtain money from the devil by tying a black cat in a bag, secured by ninety-nine knots, and selling it to the fiend as a hare at a church door at midnight. But, as soon as the bargain is struck, you must fly with all haste, for, if you reach not the shelter of a Christian roof ere the fraud be discovered, you are lost for ever. The hare, like the cat, was a common form for a witch to assume, and Alston printed the charms to effect the transformation either way used by Isabel Gowdie, who was convicted of witchcraft in Nairnshire in 1662 (*Zoologist*, 1867, 977, from *Chambers's Domestic Annals of Scotland*, 1858, ii., 287).

The animal appears also in ancient **pharmacies**, and some wonderful remedies in which it plays an important part may be found in Topsel, Gervase Markham, and doubtless many other works.

There was a curious Devonshire village custom, now extinct, called the "hare-hunt," which was intended to ridicule a man who submitted to a rough woman's tongue (Baring-Gould's *Red Spider*, 1887, xxiv., in *Dial. Dict.*).

A strange fiction, that hares having no eyelids, or only very short ones, **sleep with open eyes**, was at one time very widely accepted, and still appears in the works of popular writers. Although not found in Aristotle, the belief is very ancient and runs through the works of many of the late Latin and Greek writers. Topsel had it evidently from Gesner, and Daniel repeated it in his *Rural Sports*. It may possibly be traceable to a remark of Xenophon's (*Cyngeticus*, v., 26) that there are many reasons why hares have bad sight: their eyes project, and the eyelids are not sufficiently

long to protect the ball, which circumstance, added to the quantity of sleep that they take, renders the sight indistinct. A curious alternative explanation was that the eyelids are certainly closed in sleep, but are so thin as not to obscure the sight; and this legend has a certain underlying substratum of truth in the undoubted difficulty experienced in finding a hare asleep. No matter how close an approach she allows as she lies in her form, her eyes are always open. In fact even tame hares rarely become so trustful as to allow themselves to slumber with closed eyes in the presence of man. But the poet Cowper (*Gentleman's Mag.*, June 1784, 412, etc.; his epitaph on Tiney, *Journ. cit.*, December 1794, 935), and, later, Drane (*Trans. Cardiff Nat. Soc.*, xxvii., ii., 1894-95, 101-109; *Field*, 25th March 1905, 505), found that, when thoroughly docile, they close their eyes like other animals, and the pupil is then much reduced in size. Drane has opened an eyelid of a sleeping pet hare when the effect of the light was seen to cause an expansion of the pupil of the single eye even before the animal awoke. In sleep the eyes are so deeply sunk in their sockets that when closed they are level with the surrounding surface. When fully awake they project beyond it, but the extent of the protrusion varies with the will of the animal, and in the same way the extent of white conjunctiva visible may vary from a considerable amount to none at all.

Occasional reports of **horned hares** have been usually regarded as the product of a vivid imagination. They are believed to be sometimes founded on confusion with a roebuck, but more often may be perpetuated by fraud, as shown by Scherren (see *Field*, 1st and 22nd June 1907, 870 and 1063; also Yates, *Journ. cit.*, 15th June 1907, 1015), the former of whom reproduced the figure of a "horned hare" after the German Ridinger (*Vorstellung der wundersamsten Hirschen*, pl. 80). The belief in their occurrence is certainly ancient, and is found in so many old writers that it is not necessary to mention names. Grew (*Musæum Regalis Societatis*, 1681, 25) catalogued a reputed pair of such horns in the collection of the Royal Society, but thought it probable that they had belonged to a small deer.

This puzzle may perhaps be explained by the experience of

American naturalists, who are well acquainted with similar growths in the cottontails inhabiting the dry regions of the west. Thompson Seton (i., 672, and fig. 181) has figured the head of a prairie hare carrying a pair of horns each about 3 in. long, and distinctly resembling those of a roebuck. But there may have been something wrong about this particular specimen, of which he remarks that it was in a sealed glass case, so that a close examination was impossible. The growths appeared to be of real horn, and had no resemblance to those which he had hitherto seen on "Rabbits" (*i.e.* hares).

In any case, the existence of horned hares is now proved to admit of a reasonable explanation, and it is possible that the phenomenon may in Europe also be restricted to the drier parts remote from the British Islands. The description of the American "horns" by Nelson (*North Amer. Fauna*, No. 29, 1909, 24) may be copied in its entirety:—"A more curious but less serious disease is most common among cottontails west of the Mississippi River. This is the growth of long, conical, horn-like excrescences on the skin, usually on the head, which appear to have a close similarity to warts and not to affect the general health of the victim. These excrescences vary in number from one to half a dozen and are an inch or two in length. They stand out at right angles from the skin, and look like little horns. Sometimes they grow symmetrically on the top and sides of the head, giving the animal a remarkable appearance."

The **chase** of hares has occupied the attention of mankind from the remotest period of which there exists any record, and the ancient Egyptians and Assyrians have left drawings of it on their monuments (see Wilkinson, *Manners and Customs of the Ancient Egyptians*, ed. Birch, 1878, ii., 78-92; Layard, *Nineveh and its Remains*, 1849, ii., 430); the former kept hares in special preserves.

A hound resembling a modern greyhound appears in the Egyptian sculptures, but there is nothing to show exactly how it was used. It is, however, remarkable that hunting with dogs is nowhere mentioned in the Bible, and the word "greyhound," which appears in the authorised version of the Book of Proverbs (xxx., 31) should probably be rendered "horse," *i.e.* "war-horse," as is suggested in a marginal reading of the Revised Version.

Hare-hunting was mentioned by Homer (? 850 B.C.), both in the *Iliad* and the *Odyssey*; and it is also referred to in "The Shield of Hercules" (line 302), a poem ascribed, but with doubtful propriety, to Hesiod (? 700 B.C.; see ed. Paley, 1883). It was a favourite amusement of Xenophon, who (in a treatise mentioned on p. 235) described it as already a well-organised sport of long standing, although, as might have been expected, not so advanced as under modern methods, since Xenophon seems to have had very little idea of giving the quarry "fair play."

Another Greek writer of repute, Arrian, who was born about the close of the first century of the Christian era, was probably the first to describe true coursing in a work also named *Cynegeticus*. Of this a most valuable critique and translation into English, entitled *Arrian on Coursing*, was published anonymously in 1831 for Bohn's library; but in the unsigned article on "Coursing" in the 11th ed. *Encyc. Brit.*, 1910, vii., 321, its author is stated to have been the Rev. W. Dansey.

Amongst the most interesting parts of Arrian's work is his account of his favourite greyhound "Hormé," whose manners and habits appear to have differed in no important detail from those of modern dogs.

According to Arrian the Gauls of his day were very keen coursers, and their hounds formed a definite breed already well known as the "canis gallicus."

As a matter of fact, these early greyhounds were not always used according to modern notions of legitimate sport, but were often combined with the slower hounds that hunted by scent, as is well shown in two plates¹ opposite pp. 182 and 196, in Baillie-Grohman's 1909 edition of *The Master of Game*. It was, therefore, not until our ancestors began to separate the usage of hounds which worked only by sight from those employing scent, and to restrict the former to the pursuit of a definite quarry, that a state of things approaching modern conditions came in view.

In other respects very little real difference is perceptible

¹ These, with others of great interest published in the same work, are reproduced from a French MS. of Gaston de Foix's *Livre de Chasse*, no satisfactory English illustrations of the period being available.



HEAD OF IRISH HARE (*Lepus hibernicus*), Male.



between the methods of modern and ancient coursing. In both periods the votaries were of two classes ; those who wished to fill their pot, and those who wished to test their hounds. The latter have always shown the true spirit of sport, and the words of Arrian (*op. cit.*, 108-109)—“ For coursers, such at least as are true sportsmen, do not take their dogs out for the sake of catching a hare, but for the contest and sport of coursing, and are glad if the hare meet with an escape ”—could not be improved upon in our own time. Thus the spirit of the modern courser breathed in Arrian, whose ideas are shown to have advanced in no small degree as compared with those of his predecessor and acknowledged master, Xenophon.

In point of time others preceded Arrian, since several of the great writers of classical Rome described or mentioned the sport. It was, for instance, casually touched upon by the poets Virgil, 70-19 B.C. (*Georgics*,¹ i., 307), Horace, 65-8 B.C. (*Epod.*, 2, 35), and Ovid, 43 B.C.—A.D. 17 ; the latter's descriptions (*Metamorphoses*, i., 533, and vii., 780) of a single-handed course being the first found in the literature of classical Rome. Martial crowned the hare chief of all quadrupeds in the line—*inter quadrupedes mattea*² *prima lepus* (*Epigrammatica*, xiii., 92), and Julius Pollux (*Onomasticon*), Oppian (*Cynegetica*), and Nemesian (*Cynegeticon*) each wrote special treatises on its capture. The later Romans held it in great estimation, hunted it with a special breed of hounds, and confined it, with other animals, in special enclosures. Thus Varro (*De Re Rustica*, bk. iii., chap. xii.) states that Pompeius formed a park (“septum”) in France (Gallia Transalpina), containing the compass of four thousand paces, wherein he preserved, not only hares, but also dormice and bees ; and the “leporarium” therein was so constructed as to be impenetrable to cats, badgers, wolves, and eagles.

The honour surrounding hares, has, however, been very unequally distributed, and there have been nations and sects, such as the followers of Zoroaster, as well as the Mohammedans, Copts, and Jews, to which their flesh was, or is, entirely forbidden.

¹ “Tum gruibus pedicas et retia ponere cervis,
Auritosque sequi lepores.”

² In some versions *gloria*.

The reason for this prohibition amongst the ancient Hebrews, as laid down in Leviticus xi. 6 — “And the hare, because he cheweth the cud but divideth not the hoof, he is unclean to you”—was certainly not founded on fact. Hares have, however, a curious habit, as pointed out by Drane (*op. cit.*, 106), of grinding their incisor teeth when sitting in their forms, as well as of passing their food twice through their body, which may have led to the belief that they chew the cud. The habit of grinding the teeth is mentioned also by Woodruffe-Peacocke (*op. cit. supra*, 10), who finds that it is used by British Brown Hares as a means of passing along an alarm.

In Britain, as known to Julius Cæsar (*De Bello Gallico*, v., 12), hares, although plentiful, were accounted unclean beasts and unfit for food, a prejudice still in force in the Isle of Man, where, according to Kermode (*Zoologist*, 1893, 63), “the natives would not think of eating a hare.”

The animal plays, however, an honourable, though mythical part, in some legends; for Queen Boadicea is said to have released one from her cloak at the conclusion of her famous oration, and the story goes that by its fortunate course her soldiers were inspired to victory. (Xiphilinus's *Epitome of Dion Cassius's Historia Romana*, bk. lxii.)

The history of early British sport is very meagre, but in later times there were tabulated in Wales elaborate rules governing the chase; and these may be found amongst the laws of Howel the Good (see *The Ancient Laws of Cambria*, 1823, bk. i., 367), who is said to have reigned as paramount King of Wales from A.D. 940 to 948. In those days the pursuits of the hare, fox, and roebuck were accounted the “three clamorous hunts.” Hare's flesh was also reckoned next after that of the stag in the list of the “best flesh of the chase” (*op. cit.*, 368), and before that of the wild boar and bear; but, strange to say, the skin or fur is not included in the interesting list of values found in the same work (bk. iii., 232).

Under the Anglo-Norman kings the British Hare was highly esteemed by sportsmen, and it is often alluded to in literature of the period. It appears to have given the name

to a special breed of fast hounds or *leporarii* in 1184 (*Stubb's Select Charters*, 1895, 157), and a royal pack of harriers is mentioned in 1485 ("Wanderer," *Field*, 30th March 1912, 652).

In Twici's *Art of Hunting*, written about 1327, the animal heads the lists of hunted beasts, and the reason given is "Because she is the most marvellous beast which is on this earth. It carries grease,¹ and it croteys,² and gnaws, and these (things) no beast in this earth, does except it. And at one time it is male and at another time it is female." The last reason is imaginary, and the earlier ones are based on the technicalities of the chase; but the quotation well illustrates the high regard in which the animal was held.

In the most famous hunting book of England, that of Edward, second Duke of York, who was the Master of Game to King Henry IV., A.D. 1406 to 1413 (see Baillie-Grohman's eds. of 1904 and 1909), itself largely a translation from the even more famous French of Gaston de Foix (*Livre de Chasse*, A.D. 1387), the hare again heads the list of "beasts of venery and chace," coming even before the stag. Any modern sportsman might envy the Master of Game's knowledge of its habits, and his opinion of it is given as follows (ed. 1909, 14):³—"The hare is a good little beast, and much good sport and liking is (*sic*) the hunting of her, more than that of any other beast that any man knoweth, if he were not so little."

In the *Boke of St Albans* (1486) the hare retains a high, or even a higher position, for we read that "That beest Kyng shall be calde of all venery. . . . He is the mervellest beest that is in any londe."

By most subsequent writers, such as Shakespeare,⁴ coursing,

¹ A technical term used amongst sportsmen for the fat of some animals of the chase, see below, p. 254.

² "Croteys" were droppings, see below, p. 254. Apparently the hare was the only beast combining grease and croteys; all others with grease had fiant (Dryden's *Twici*, 1908, 38).

³ Note the hare is here called "he" and "she" indiscriminately, in accordance with the strange belief of the time regarding its sex, see above, pp. 239-240.

⁴ "If I fly, Marcus, halloo me like a hare."—*Coriolanus*, 1, 8.

"Say thou wilt course; they greyhounds are as swift
As breathèd stags, ay fleetèr than the roe."

—*Taming of the Shrew*, Introduction, sc. 2.

although laxly prosecuted, is taken as a matter of course, and the description of a hunted hare in *Venus and Adonis* is probably the finest in the language. But it is a remarkable thing that in France, the apparent land of the birth of coursing, that branch of hare-hunting declined so much that an English translator of Du Fouilloux's French treatise *La Venerie*, from which in 1575 or thereabouts he compiled *The Noble Arte of Venerie*, on account of the absence of any description of it in the French work, was compelled to introduce an original chapter on the subject.

Coursing, as we understand it now, dates from the time of Queen Elizabeth (Blaine, *Encyc. Rural Sports*, 1875, 562 and 584), in whose reign the first set of English rules for determining a course were drawn up by Thomas, Duke of Norfolk. No open trials were heard of, however, until half a century later in the time of Charles I., and the oldest regular coursing club, that of Swaffham, Norfolk, dates only from 1766 ("Coursing," *Encyc. Brit.*, 11th ed., unsigned).

Hares were formerly taken with hawks, but this sport, like **hawking** generally, is now, for practical purposes extinct in England. It is practised, however, and is very popular in several parts of the world, especially amongst some of the wilder Asiatic tribes; and it must have appealed strongly to the Greeks of classical times, for the capture of a hare by a large bird of prey was considered worthy of description by Homer (*Iliad*, xxii., 391), by the poet Æschylus in his tragedy *The Agamemnon*, and by Aristotle (ed. Thompson, 191, ix., 32, 619^a, 36, etc.), the latter of whom refers to a particular raptorial bird as the "hare-killer" (*op. cit.*, ix., 32, 618^b, 30).

According to Poland, there has not been in recent years much traffic in British **hare skins**; but in old days the reverse must have been the case, since Fleming¹ states that as many as thirty thousand—of course not all Brown Hares—have been sold in Dumfries market in February.

¹ See also Robert Service, *Scott. Nat.*, July 1891, 97-102.

GROUP EULAGOS.

British Hares fall into two groups, distinct in origin, structure, and habits.

The first, for which Gray's name *Eulagos* (1867) seems to be available, includes *L. mediterraneus*, *L. europæus*, *L. granatensis*, with their allies, and probably a number of Old-World hares other than the varying hares as differentiated below. In *Eulagos* the head is smaller, the eyes less prominent, the ears and tail longer, and the limbs, especially the fore, shorter. The pelage is coarse, not woolly, without marked juvenal or post-juvenal changes, the whiskers are long and coarse, the upper side of the tail is black, and there is a conspicuous autumnal moult. There are only six mammæ.

In the **skull**, as exemplified by *L. europæus*, the brain-case is narrower and deeper than in *L. timidus*, the frontal region is not concave, and the superciliary processes are but little raised above the level of the skull, so that the profile of the cranium is fully arched. The nasals are large, their greatest length, as a rule, considerably exceeding that of the median frontal suture. The anterior portion of each zygoma is relatively shallower, the distance from the anterior termination of the groove on the outer surface to the front edge of the arch being greater than the least depth.

In the **teeth** the upper incisors are broader, more curved, and their roots do not extend beyond the premaxillo-maxillary sutures. The posterior upper premolars are short, their height measured from crown to extreme upper point of root-capsule within the orbit being less than the alveolar length of the tooth-row, instead of being greater, as in the varying hares of the group *Lepus*.

The **mandible** is characterised by its relatively low dimension of height, a consequence of the shorter molar crowns, by the slightly broader incisors, and by the ventrally broad symphyseal region, which has its inner margin sharp, instead of rounded, as in the varying hares.

The differences between the skulls and teeth of *europæus* and *timidus* are discussed by Hinton (*Sci. Proc. Roy. Dublin*

Soc., xii. (N.S.), No. 23, September 1909, 225, etc.), who gives numerous references to the literature, including the work of Nathusius, Forsyth Major, Winge, Lönnberg, Lyon, and Nelson.

In *L. europæus* the scapula is proportionately narrower than in the varying hares.

This group, which in Britain is represented by *L. europæus*, is only a comparatively recent immigrant into Western Europe, where it has superseded the members of the true *Lepus* group. The broader and shorter incisors and less deeply-rooted upper cheek-teeth suggest that its members are naturally graziers on soft grassy herbage rather than on the stronger stalks of herbaceous plants, bushes, or the bark of trees. The longer ears, extremely long whiskers, more highly developed olfactory region, and less prominent eyes, are probably indicative of a more nocturnal habit. The fur is that of a recent immigrant from less rigorous regions than those at present occupied by the true hares, and the lesser number of mammæ point to smaller, although, perhaps, more frequent litters of young.

No doubt further subdivision will be required when the members of the group *Eulagos* are better understood. The main convenience to systematists of the present arrangement is that it defines the group of true *Lepus*, under which is given a fuller discussion of the distinctions.

THE COMMON OR BROWN HARE.

LEPUS EUROPÆUS, Pallas.

LEPUS EUROPÆUS OCCIDENTALIS, de Winton.

1666. *LEPUS, a Hare*, Christopher Merrett, *Pinax*, 168.
 1693. *LEPUS*, Λαγὼς Græcis, The Hare, John Ray, *Synopsis Methodica Animalium Quadrupedum*, etc., 204.
 1756. LE LIÈVRE, L. J. M. Daubenton in E. L. le Clerc, Comte de Buffon's *Histoire Naturelle*, vi, 264-299; described from Burgundy, France.
 1777. *LEPUS TIMIDUS* (species, *nec* Linnæus), J. C. R. Erxleben, *Systema Regni Animalis*, 325 (part); Berkenhout; Turton; Bingley; Fleming; Jenyns; Bell (ed. i.); MacGillivray; Fatio.
 1778. *LEPUS EUROPÆUS* (species), P. S. Pallas, *Novæ Species Quadrupedum Glirium Ordine*, 2, 30 (part); naming Daubenton's "Le lièvre" = *L. europæus europæus* (Pallas); Lydekker; Thomas, *Zoologist*, 1898, 101; Johnston; Millais; Winge; Hinton, *Sci. Proc. Roy. Dublin Soc.*, xii. (N.S.), No. 23, September 1909, 226; Trouëssart (1910).

1857. *LEPUS TIMIDUS*, b. mitteleuropäische form, J. H. Blasius, *Säugethiere Deutschlands*, 417 (part).

1898. *LEPUS EUROPAEUS OCCIDENTALIS* (sub-species), W. E. de Winton, *Ann. and Mag. Nat. Hist.*, February, 152; described from Herefordshire, England (type No. 98.2.17.1 of British Museum Collection); Hilzheimer, *Zool. Anzeiger*, xxx., 512, 14th August 1906; Trouessart (1910).

Le Lièvre of the French; *der Hase* of the Germans.

The **synonymy** and **history** given here is mainly that of the British Brown Hare, *L. europæus occidentalis*, a recognisable sub-species first differentiated by de Winton in 1898. That of the species as a whole and of the other sub-species will be found in works on European mammals, and is in all cases quite simple, since, under the rules of priority, there can be no doubt about the correct names for the Brown and Blue Hares. Yet there has been much confusion in the past, owing to causes similar to those surrounding the synonymy of the bats and shrews. The Hare to which Linnæus applied the name *timidus* is not the common hare of Europe; but this fact was not at first understood, so that this name was widely applied to the present as being much the better known species. After the discovery of the identity of the true *timidus*, some naturalists retained that name for the Brown, and adopted Pallas's name *variabilis* for the Blue Hare. This course is still followed by a few zoologists, especially biologists and those working on extinct forms; but the majority of authoritative systematic writers have now, although not without protest, agreed to adopt the next available name, viz., Pallas's *europæus*, for the Brown Hare, leaving the Blue Hare to be *Lepus timidus*, as originally intended by Linnæus. The names of other sub-species will be found under *Geographical variation*.

Sex names:—Jack, or buck; jill (and gill), or doe.

Terminology:¹—The word *hare* appears in Middle English, as in Chaucer. The Anglo-Saxon form is *hara*, the Swedish and Danish *hare*, and the Icelandic *heri* (for an original *here*). But in the Dutch, Middle Dutch, and Old High German forms, the original "s" is retained in place of the "r," from a Teutonic stem, *hason*. On the other hand, the Welsh *ceinach*—"a hare," is believed to be certainly connected with *sasnis*—"a hare"—one of the very few words of Old Prussian (Slavonic dialect) which have been preserved. This appears in Sanskrit as *çaça* (for an original *çasa*), a word which was assimilated by popular etymology in Sanskrit with *çaç*, to jump; but the real meaning of the original Sanskrit form was certainly "grey." The original signification of *hare* is thus shown to be the "grey animal"; with which compare *grey*, a name of the Badger. Thus the Anglo-Saxon words *hasu*—"grey-brown," and *hara*—"a hare," are directly connected.

¹ Without reference to species.

Hare is also used both as a surname and in place-names (*e.g.*, Harewood, Yorkshire), and appears in many compounds and names of flowers, as hare-lipped, hare's-ear, hare's-foot, hare's-tail, harebell, and others. To "make a hare of a man" is a well-known Irish expression signifying to rout him completely, especially in argument, as in a well-known popular song—"Father O'Flynn would make hares of them all."

By sportsmen "hare" is often used in the feminine gender.

The sex-names "jack" and "jill," or "gill," are survivals of familiar but somewhat depreciative Middle English terms for "boy" and "girl"; compare the old nursery rhyme beginning "Jack and Jill went up the hill." "Jill" or "gill" is from Middle English "jille," "gille," "jylle," or "gylle," abbreviated from "Gillian" = "Julian," from "Juliana," from Latin "Julia," feminine of "Julius"; compare "gillet" or "jillet" = a giddy young woman, a jilt (*Dial. Dict.*).

"Leveret," the common word for a young hare, comes, as shown below, from the French.

Local names¹ (non-Celtic):—*Bandy*, from the curvature of the hind legs, of East Anglia, including Norfolk; *baud* or *bawd*, a shortened form of *bawdrons* = "a cat," of Scotland, Derby, and Nottingham—see also under Wild Cat,—explains an otherwise pointless passage in *Romeo and Juliet*, II., iv.—

"*Mercutio*. A bawd, a bawd, a bawd, so ho !

Romeo. What hast thou found ?

Mercutio. No hare, sir ;"

as well as the following from *Poems in Buchan Dialect* (1783, 23), quoted by Jamieson—

"I saw (and shame it was to see)

You rin awa' like bawds" ;

bautie, *bawtie*, *bawty*, of Scotland and Cumberland, is also applied to dogs; *bettie*, of Kirkcudbright (Service, *Zoologist*, 1878, 427); *bun*, see Rabbit; *cuttie* = "short"-tailed, of Scotland, a name usually applied to the wren; *donie* = "the little dun-coloured" animal, given by Jamieson as of the Angus dialect, but not known to Wright's correspondents (*Dial. Dict.*); *fennel*, a female hare when giving suck; *fuddie*, of Banff and Aberdeen, from *fud*, the tail of a hare or rabbit, as in Burns's *Tam Samson's Elegy*, 1787, vii.—

"Ye maukins, cock your fud fu' braw,

Withouten dread,

Your mortal fae is now awa'";

great hare, a three-year-old; *jack-rabbit*, see Rabbit; *katie*, of Scotland, Cumberland, and Shropshire; *laverock* or *lavrock*, of Northumberland and the North of Ireland, evidently a mistake for *leveret*, a young hare,

¹ Without reference to species.

as explained below; *malkin*, of Scotland and North Yorkshire, from *maldkin* or *maudkin*="little Maud," a familiar cat-name transferred to the hare (cf. *grimalkin*, a cat="grey malkin," of some parts of Scotland, and of Northumberland and Cumberland), appears also as *maukin* or *mawkin*; *mally*, of Durham; *mupsie*, a pet or young hare (*Dial. Dict.*), see Rabbit; *old aunt*, of Norfolk, as in Emerson's *Birds, Beasts, and Fishes of the Norfolk Broadland*, 1895, 325; *old Sarah*, of Suffolk (compare *Sarah* of Yorkshire); *puss*, a quite general term, as in Cowper's well-known poem; *scut*, see Rabbit; *wat* or *watty*, corrupted from *Walt*=*Walter*, an old familiar name, still in use locally, and of some antiquity, compare Shakespeare's

"And when thou hast on foot the purblind hare,
Mark the poor wretch
By this, poor Wat, far off upon a hill
Stands on his hinder legs with listening ear"

(*Venus and Adonis*);

whiddie and *whiddy*, of Aberdeen, Banff, Orkney, and Shetland, the sense of which is "nimble," as in Taylor's *Poems*, 1787, 91—

"Rob then to her did hunt his dogs . . .
But Whiddie wi' her cockit lugs,
Said, 'Kiss your luckie.'"

In old sporting books "the Hare is a *Leveret* in the first year, a *Hare* in the second, and a *great Hare* (cf. "great cony," above, p. 189) in the third" (Daniel, *Rural Sports*, 1801, i., 260); of these terms, *leveret* is from Old French *levret*, diminutive of Old French *levre*, modern French *lièvre*—from Latin *lepus*, genitive *leporis*—"a hare."

Besides those mentioned above, a surprising number of fanciful names were bestowed on the animal by Anglo-Norman sportsmen, amongst whom there must almost have been a cult or worship of it; see above, p. 246, etc., under genus *Lepus*; many of these may be found in Wright and Halliwell's *Reliquiæ Antiquæ*, and I have reprinted them (*Zoologist*, 1911, 25-26). Westropp informs me that a somewhat similar set of fanciful appellations existed in the Irish language, and they may possibly have been derived from the Normans also.

Amongst the old sporting terms, "meuse," "muse," or "smeuse" is still retained in many districts to indicate the openings or passages by which a hare is accustomed to pass through a hedge, and is also used sometimes to signify her "form." It is from the Old French *musse*—"a little hole" or "corner to hide things in," from *musser*=to hide, and was also applied in connection with other animals, such as the wild boar. The word "muset" was used in the same sense by Shakespeare in *Venus and Adonis*, in connection with a hunted hare—

"The many musits through the which he goes
Are like a labyrinth to amaze his foes."

Another old term, the "relief" of a hare, from the French *relever* = to arise, hence = her arising to go to her pasture, and in later usage = her feeding, seems to have fallen into disuse.

A hunter was said to "quest" or "seek" for a hare. This, in the time of Twici, huntsman to King Edward II., he did with a "limer" or "lymer," that is a scenting hound led in a "liam" or leash, which practice, however, seems to have died out subsequently, since it is not advocated as a part of hare hunting by *The Master of Game*. When found in its form, the animal was "moved" or "started." When caught it was "stripped" or "eased" of its "skin, and its fat was usually known as "grease," as by Twici and the Master of Game, but in *The Boke of St Albans* it is called "tallow."

The old MSS. contain many other sportsmen's terms. The droppings were known as "crotels," "croties," or "crotishings." We read of "A huske of hares, a don of hares"; again, "A hare ys formed schulderying or lenying . . . a cony sytteth" (MS. Digby, 196, 160-161; 15th century MS. in Bodleian Library, Oxford).

Of the numerous epithets applied to hares, the most famous is "mad," which is confined to the expression "mad as a March hare" (*cf.* however, "hare-brained"). This idea has been immortalised anew by "Lewis Carroll" in *Alice in Wonderland*, but is of old standing, since it is mentioned in an early 15th-century (about 1420) translation of Palladius on *Husbondrie* (Early Eng. Text Soc.), 62, lines 36-38—

"Yit in this moone is for to sowe tares
And not in March, lest they ennoie thi beestes,
Thi oxen might be woode thereof as hares."

The two next most common epithets are "timid" or "timorous," and "melancholy." The latter has been variously, but never yet satisfactorily explained; it occurs in Shakespeare, as in *Henry IV.*, i, 2—"What sayst thou to a hare, or the melancholy of Moorditch?" According to the author of *The Noble Arte of Venerie* (1575, 160), the hare "is one of the moste melancholike beastes that is"; and this supposed quality is discussed in Baillie-Grohman's editions of *The Master of Game*. The beast figures also as the "merry brown hare," as in Charles Kingsley; "purblind" in *Venus and Adonis* (see above, p. 253); and "intelligent," the latter quality, as well as that of timidity, being shared with the stag in Aristotle's *Historia Animalium* (ed. Thompson, i, 1, 488^b 15), and being therefore of very ancient origin.

(Celtic):—Old Irish—*cermna* (Cormac) is glossed as meaning "brown hound in the brake"; the same explanation is given of the modern Irish *fiadmuin*, *fiamuin*; *gearr-fhiadh* (pronounced *gearree*), literally = "small deer"; *miol mhaighe* = "beast of the field" or "plain"; *pata*, *patan*, with diminutives *paiteog*, *patachan*, *pheatán*, the latter in Wilde, *Proc. Roy. Irish Acad.*, vii, 1862, 188.

Scottish Gaelic—*gearr*="a hare," *gearrag*="a young hare or leveret," and *maigheach*="the 'field' animal," from *magh*=a "field" or "plain," are general terms, to which (*vide* C. H. Alston) *bhàn* is added for *L. timidus* in winter, and *ruadh* ("red") for *L. europæus*.

Manx—*mrwaagh* (=Scottish *maigheach*).

Welsh—*cath eithin*, lit.="cat of the furze"—compare the old English name "furze-cat" applied to the hare in *Reliquiæ Antiquæ*, I., 133; *ceinach*, a hare (already mentioned); *ysgyfarnog*, lit.="the eared animal," from *ysgyfar*="an ear," and *ysgyfarn*="the ear of a beast."

Cornish—*scovarnek*, *scovarnog*.

Distribution:—The Common Hare is found naturally in several sub-specific forms from Great Britain to the Ural mountains; and from Scotland, Denmark, the shores of the Baltic, and the White Sea districts of North Russia (Blasius), southwards to the river Ebro in Spain (Cabrera, *in lit.*), Italy, the Balkan Peninsula to the Peloponnese, the northern shores of the Black Sea to the western shores of the Caspian, the districts south of the Urals, and south at least to Trebizond.

It is quite a recent immigrant or introduction in Scandinavia and Finland, where, as in Arctic Europe generally, in Ireland, and in the higher portions of the Alps, members of the group of varying hares are alone indigenous; in Sweden, it now ranges north of 56° N. lat. (Lönnerberg), and in Finland is spreading northwards.

It meets in Spain a very distinct hare, *L. granatensis* of Rosenhauer (1856)=*L. meridionalis* of Graells (1897)=*L. lilfordi* of de Winton (1898), which is found in the Balearics, and Iberian Peninsula south of the Ebro, but in the north-west ranges up to the Pyrenees and just into France. This is a small species, with hind feet measuring (including the claws) 115 to 125 mm., characteristic skull, the outer surfaces of the thighs bright ochraceous, and the feet marked with white; it has three sub-species.

L. europæus does not occur in Sardinia, where is found *L. mediterraneus* of Wagner, a distinct small hare of dull coloration, with long ears, and the hind feet (including the claws) measuring 95 to 108 mm.; and it is not indigenous either to Corsica or Sicily, its presence in both those islands being due to introduction. Thus Polybius (*History*, § 12) stated that in his time (B.C. 204) it was unknown in Corsica, and, as regards Sicily, Julius Pollux (*Onomasticon*, v., § 12) quotes Aristotle as stating (in a lost work) that the tyrant Anaxilas of Rhegium introduced hares into that island, thus explaining their presence on the coinage of Sicily and Rhegium (see Hill, *Coins of Ancient Sicily*, 1903, 47). The same authority gives details of the introduction of hares in Karpathos, to the detriment of the crops. *L. europæus* appears to be absent also from the Parnassus mountains of Greece, whence Miller has recently described *L. parnassius*, which resembles *L. creticus*, but is larger, has longer ears, and distinct skull and teeth. The representatives in Crete and

Cephalonia, and in Cyprus are two closely allied hares, *L. creticus* of Barrett-Hamilton and *L. cyprius* of Barrett-Hamilton. The former is a comparatively small hare (hind feet, 120 to 135 mm.), with relatively long ears; the latter is similar, but has the cheeks and ears suffused with buff.

The eastern boundaries of the range of *L. europæus* are still very imperfectly known, and from the Talysh and Mugan steppes Satunin has described *L. cyrensis*, a form of doubtful affinity, while in the East, in parts of Asia Minor, Egypt, and North Africa, occur a number of species, the relationships of which still require elucidation.

Amongst the countries where *L. europæus* has been introduced are La Plata (Thomas, *Ann. and Mag. Nat. Hist.*, March 1910, 246), New Zealand (Macpherson, *The Hare*, 7), Barbadoes (Wallace, *Encyc. Brit.*, 11th ed., art. "Acclimatisation"), and Jersey, where, however, it may have been previously indigenous (Bunting).

[*L. europæus* is said to have died out in Switzerland and to have been reintroduced; some specimens of the new stock in the collections of the British Museum of Natural History are of the sub-species *occidentalis*.]

In the **British Islands** *L. europæus occidentalis* is not indigenous to Ireland, but, where not persecuted, is abundant throughout **England**, **Wales**, and **Scotland**, except on the higher parts of the mountains. It does not object to the vicinity of towns and villages, and Boyd Watt has seen one inside Queen's Park, Glasgow. It was plentiful in some of the London parks until some time in the nineteenth century, there being records of the capture of one in Hyde Park in 1809, and of coursing matches held in Regent's Park between 1824 and 1828 (Harting, *Essays on Sport and Nat. Hist.*, 1883, 234-235). One was killed at Hammersmith in 1892 (Cornish, *Shooting*, 1903, ii., 161), and another in fields surrounded by houses between Walm-lane and Brondesbury Station (Bulleid, *Field*, 24th June 1899, 907). There is, however, almost unanimous testimony amongst local naturalists that its numbers, although now, perhaps, again on the upgrade, have been much reduced since the passing of the Ground Game Act of 1880. Before that date its abundance in some districts was quite extraordinary, and the damage done to farmers must have been very great. To give a Scottish instance, it was stated that in Kincardineshire (Robertson's *Agricult. Surv. Kincardineshire*, 1807, quoted by Sim), hares "are incredibly numerous, abounding in many parts in dozens in every field. I am fully persuaded that there are many more Hares than Sheep in this country, only they have changed places. The great body of Sheep are sent to pick up a scanty subsistence on the barren hills; but the Hares, left to the freedom of their own will, prefer to live at their ease in the low and rich parts of the country. Without having seen it, one could hardly con-

ceive the quantity of turnips that they destroy." In Suffolk, at Sir Thomas Gooch's in 1806, there were killed no less than 6000 (Blaine, *Encyc. of Rural Sports*, 1875, 508; *Shooting*, cit. supra, 17). In much later years 823 have been shot on one short December day in 1869, and 1217 during three consecutive days of November 1878, in different localities. Of late years, however, the species has run considerable risk of extermination where it has not the sanctuary of a big preserve; in many localities it has disappeared or is becoming yearly scarcer, and in most it is described as decreasing. Still, big bags continue to be obtained by sportsmen in favoured localities, and in 1902, in Cambridgeshire, 1100 were shot in a single day (Cornish, *op. cit.*, 154-155). Many coursing clubs also flourish all over the country, and in 1911 there were 132 packs of harriers, of which 40 were Irish (*Field*, 14th October 1911, Suppl., xvii.-xviii.).

This hare has a predilection for situations in which its favourite food-plants are plentiful, and on such ground it is most numerous, as well as heavier and more healthy. Millais mentions as favoured resorts the fens of Lincoln, the wild, open, sandy districts of Norfolk, Suffolk, and Cambridge, the lowlands of Essex, and the great fields of Shropshire; and in Scotland, the border counties, the Earn and Tay valleys, Donibristle in Fife, and the neighbourhood of Elgin and Forres. Cornish (*op. cit.*) thought that, considered as hare preserves, probably there is in the south nothing quite like the marshes of Southminster, Essex; Cliffe, Kent; and Sudbourne, between Aldborough and Hollesley, Suffolk; but in such localities floods are sometimes very destructive, as when the phenomenal high tide of 1898 drowned many hares at Orford.

On the whole, this hare is to be found in artificial rather than in natural country, in cultivated fields rather than on moors, in plains rather than on mountains. But it is not absolutely restricted to these more pleasant haunts. In North Wales, according to Forrest, it likes high ground to over 2000 feet; and in Scotland generally is found up to about that limit. In the Moray area it follows cultivation far up the glens (Harvie-Brown and Buckley). In the Edinburgh district, although most numerous in the plains, it occurs in all the hill-valleys, and in summer even encroaches on the ground occupied by the Blue Hare on the hill-slopes (W. Evans). Millais has seen one shot at 2500 feet during a White Hare drive in Scotland, and has frequently killed them on the hills above Pitlochry, Perthshire, at about 1500 feet.

In the highlands and north of Scotland the range of the Brown Hare has always been more restricted, owing to the comparative scarcity of suitable ground; but it is, or was locally common in many districts to the extreme north of Sutherland and Caithness.

It is hard to give a list of **islands** to which this hare is indigenous, as it is so often introduced. It is present in Wight

(Bury, More), Anglesey, and Man; but in the latter introduction may be suspected, although no records of it exist. It is not found in Lundy. Alston states that it does not appear to be indigenous in any of the Scottish islands, but it has been very generally introduced, as in Bute, Great Cumbrae, Arran, Islay (previous to 1816), Jura (Millais), Mull, Calve (Millais), Tiree, Coll (about 1787), Skye (Millais), and probably many others (Alston, Boyd Watt, Harvie-Brown and Buckley, Millais). To Mull it was introduced in 1814 or 1815 (Alston); but in 1895 MacLaine of Lochbuie wrote (*Ann. Scott. Nat. Hist.*, 1895, 250), that, although it was at one time plentiful, and throve well until a few years previously, it had then completely disappeared, in spite of the fact that fresh blood was imported on several occasions. That writer was at a loss to account for its total disappearance, and suggested that the want of cropping had had much to do with it. One, supposed to be the last of its race, shot in Mull on 13th December 1882, weighed 12 lbs., a weight which does not suggest deterioration.

In the Outer Hebrides the Brown Hare has been introduced on many occasions, as, for instance, in Lewis, Harris, and Barray, and its numbers have fluctuated from time to time, apparently in accordance with the amount of protection accorded to it by game preservers (see Harvie-Brown and Buckley). In the Orkneys it is now common (Harvie-Brown and Buckley), and has been introduced on Mainland (Pomona), as well as in Hoy, Eday, Rousay, Shapinsay, and South Ronaldshay (Millais). It is believed to have died out on Papa Westray (Harvie-Brown and Buckley).

In the Shetlands it was introduced early in the last century, and occurs on Mainland from Dunrossness to Mossbank (Millais).

It has been introduced into many parts of **Ireland**, and in 1898 it was possible to give details (*Irish Naturalist*, 1898, 69-76) of twelve such introductions. The imported animals succeeded in establishing themselves wherever they were given a fair chance. One of the most conspicuous instances was that of Strabane, where in 1876 65 hares are said to have been brought over from Norfolk. They throve very well, and in 1893 there was "a splendid stock of hares" (Herdman, *Land and Water*, 4th March 1893), the descendants of which still remain in numbers about Strabane, and are even said to be the only kind of hares found in that neighbourhood (D. Ker, *in lit.*, 16th December 1910).

Distribution in time:—Bones of hares have been described from numerous cave-deposits extending back to the pleistocene age. These have been variously identified with *L. europæus*, or, as from a Somerset cave, by Sanford (*Quart. Journ. Geol. Soc.*, London, xxvi., 1870, 126, pl. viii., f. 5; and *Proc. Somerset. Nat. Hist. Soc.*, xv., 1870, 53, pl. 5), with H. von Meyer's *L. diluvianus* (*Palæologica*, 1832, 61).

But the latter species, although doubtfully distinct from *L. timidus* (Wol-drich, *Sitzungsab. d. K. Akad. d. Wissensch.*, Vienna, lxxxii., 1880, ii.), and placed in the synonymy of that species by E. T. Newton (*Quart. Journ. Geol. Soc.*, lv., 421, August 1899), was described from continental Europe, and is therefore not of direct interest to British naturalists.

Forsyth Major has, however, shown (*Geol. Mag.*, dec. v., vol. i., 1904, 143) that all the British pleistocene remains of hares determinable with certainty are referable to allies of *L. timidus*. Hinton has come to a similar conclusion as the result of his studies of the late pleistocene fossil hare of Ightham, Kent (*Sci. Proc. Roy. Dublin Soc.*, xii., N.S., No. 23, pl. xv., Sept. 1909, 225-265). He further informs me that he cannot recall a single instance of any undoubted remains of *L. europæus* of even prehistoric age in Britain; even a single right tibia from the Roman camp at Corstopitum, near Corbridge-on-Tyne, Northumberland (see Meek and Gray, *Arch. Aeliana*, 3rd ser., vii., 125, 1911), is referable to true *Lepus*. Winge, however, finds *Eulagos* in neolithic deposits in Denmark, but considers it very rare. The species must certainly be regarded as a comparatively recent post-pleistocene immigrant, and its presence points either to a very late land-connection with the Continent, or to introduction in early historical times. For the latter hypothesis no confirmatory evidence can be adduced. But it is not improbable, and has parallels in the frequent practice of introducing hares throughout the known historical period. This conclusion is consistent with the absence of Brown Hares from Ireland, where, however, as shown above, they thrive well when introduced, and with their recent extension of range (though assisted by man) in Scotland, Scandinavia, and Finland (see under *Distribution*).

Origin :—It seems almost certain that *L. europæus* invaded western Europe from eastern Europe or Asia, as its status in the Mediterranean region indicates that it could not have come from north-western Africa; it must, therefore, have entered both Spain and Italy from the north in recent geological times. This irruption can hardly have been connected with amelioration of climate, since the animal is very hardy; but, as it appears to have everywhere superseded the members of the *L. timidus* group where meeting them, the matter is discussed more conveniently under heading of the latter species.

Description :—In general form and appearance this animal embodies the typical characters of a hare. Amongst European species it is distinguishable by its large size, long ears¹ much exceeding the head in

¹ As in the case of rabbits (see above, p. 194), specimens with deformed ears are sometimes seen, and one such from Bottisham Hall, Cambridge, in which, apparently by congenital defect, all sign of external ear, or even of opening, was lacking, was described by Jenyns (*Observations on Nat. Hist.*, 1846, 77). Other instances have from time to time been recorded, amongst others by Wise, *Field*, 15th Sept. 1888, 413; Clayton, *Journ. cit.*, 3rd Jan., 1891, 10; "R. L.," *Journ. cit.*, 8th May 1909, 801.

length, distinct dorsal colour pattern, lack of noticeable contrast between the colour of the sides of the body and of the outer surface of the thighs, and by the absence of white markings on the feet.

The **fur** contains the three typical components (see above, p. 162). The middle hairs are more prominent than in the Rabbit, hence the pelage is not so soft as in that animal. The whiskers and superciliary tufts are much thicker and longer than in the varying hares, and the fur on the soles coarser and harder to the touch.

The **colour** of the underfur is on the back whitish, with conspicuous dusky tips, becoming unicoloured "buff" or "ochraceous buff" on the flanks, and on the belly unicoloured white.

In the hairs, the usual order of the rings from the tip downwards is, as in the wild Rabbit, black, "ochraceous buff," black, and at the base some lighter shade; the dark tip may, however, be absent, so that the upper side of the animal, including the top of the head, is, for the most part grizzled ochraceous buff, with a not very considerable mixture of dusky where the underfur or the black hair-tips show. The shoulders, flanks, neck, nape, throat, and a band across the inguinal region are ruddier, without black, and may in richly-coloured individuals almost reach a ruddy "ochraceous brown." The flanks are sprinkled with long whitish or buff hairs having dusky bases. The sides of the face are yellower or lighter than the upper side, and these, with two more or less clearly defined bands passing from nose to ear, and including the eye, may be grey or nearly white, especially in winter. The outer surfaces of the limbs are lighter and yellower than the back, there being no black-tipped hairs. The under side is white, with the exception of the pectoral and inguinal bands already mentioned, and the inner surfaces of the limbs whitish. The tail is more or less black above; beneath white, the white overlapping and showing on the margins of the upper side. The thickly furred soles are a dirty yellowish white shade. There are numerous black or white whiskers, of which the white are the longer, and may reach a length of 90 mm. The eyelashes and a tuft of strong hairs above each eye (length 71 mm.) are black. The ears are thickly covered on the outer surfaces with short hairs, which are usually black with ochraceous tips; the inner surfaces are sparsely clothed with tawny hairs, and the bases and anterior surfaces resemble the back in colour, but are lighter. Each ear has a more or less conspicuous black apical tip, which shows only as a thick rim on the internal surface, but on the external extends downwards for a distance of about 30 mm.; beneath each black tip an indefinite band of grey spreads on to the external margin as a distinct rim.

In the hind **feet** (see Plate XX.) the two longer central and the two shorter outer digits form subequal pairs; the second is slightly longer than the fifth, and the third than the fourth; the hallux is absent.

Of the five toes on the fore feet the central is the longest, the thumb shortest and very small, but carrying a strong nail. The second, fourth, and fifth are intermediate in size in the order named. All digits carry strong claws. With the exception of insignificant tracts (figured by Boas, *Zool. Anzeiger*, xxxv., 15th February 1910, 442-443), the palmar and plantar surfaces are completely, and, according to the season, more or less heavily clothed with fur, which conceals the terminal pads of the digits and three rudimentary pads lying at their bases.

Newly born **leverets** have very short ears and a less furry tail than adults, which they soon grow to resemble, but are less thickly furred on the under side, and lack the ruddy tints of the chest and back, as well as the extra long hairs. There does not seem to be any conspicuous juvenal or post-juvenal coat.

According to the older sporting books, bucks appear to be smaller in the body than does, shorter in the head, whiter on the rump, redder on the shoulders, and greyer on the ears. The first, second, and fourth items are certainly correct; the others require further investigation.

The principal **moult** is effected in the late summer or early autumn, between July and early October (latest examined, 5th October). The fur of the back may come off altogether. The new hairs are then seen short and black without whitish bases or ochraceous tips, so as to be very conspicuous. The ochraceous tips appear as the hairs grow; later the whitish base. There seems to be a gradual change of coat in late winter or spring; Cocks (*in lit.*) has examined specimens in which the hairs were loose and the coat of the upper side not yet renewed on 11th February, and again in the last weeks of May and August; and Drane finds the fur of tame individuals in a continuous state of change throughout the year.

White facial marks are by some considered an indication of age, appearing in captive individuals at about the sixth year (Drane, MS., per Proger); together with a grey rump and whiter tail and ears, they are sometimes found in summer specimens which have not moulted properly. But they are really characteristic of the **winter coat**, which is whiter, but in a variable degree, than that of summer, so that no doubt many of the pied or grey varieties noticed below under individual variation are instances of incipient winter whitening. In such cases the ochraceous bands of the hairs disappear and the black bands are reduced in breadth. Two specimens which seemed to have undergone extensive whitening were reported from Dumfriesshire by Gladstone (*Ann. Scott. Nat. Hist.*, 1911, 113), on 20th December 1903, and 27th December 1910. In one the legs were brown; the other was "completely white, with only a suspicion of a brown hair here and there." It is probable that individuals in more or less completely white winter dress are obtained annually, especially in Scotland, and Masefield writes

me of some instances which occurred near Leek, North Staffordshire ; but the majority escape recognition, being mistaken for Mountain Hares.

The skull and teeth are typical of the group *Eulagos*, as described above on p. 249.



FIG. 47.—SIDE VIEW OF SKULL OF *Lepus europæus* (life size).

Individual variation of colour is frequent, or rather it is frequently reported, as the animal is so much under the public view that practically every conspicuous variety is noticed by sportsmen or keepers.

Black varieties (which, like black rabbits, seem to lack the white underside, see p. 198), are rare, but at least fifteen instances have been recorded, including two leverets. Some of them may have been individuals undergoing autumnal moult, as described above.

Two rich ochraceous specimens, both quite immature, in the Tomes collection at the British Museum of Natural History, are labelled "Weston Sands." To this class probably belong two tawny Scottish females in the Perth Museum, for a note of which I am indebted to Rodger.

Cream-coloured and white specimens, with the eyes pink or brown, are more numerous than the black, and are occasionally found as leverets ; but records of white or whitish varieties need careful verification, as they may have reference to the regular grey variety described below, to specimens undergoing winter whitening, or to introduced Blue Hares. Sometimes varieties of the above type are recorded to have occurred more than once, or periodically, in the same district ; and two, a male and female, were shot on the same day near Perth, and are now in the museum of that town (Rodger, MS.). White or pied specimens with blue eyes have been three times reported (Nicholls, *Field*, 21st April 1888, 547 ; Whitaker, *Zoologist*, 1889, 143 ; Hunt, *Field*, 5th October 1895, 590), and "white hares" are said to have been occasionally shot at Cubberley near Cheltenham (Witchell and

Strugnell). A "blue grey" leveret recorded by Warde Fowler (*Field*, 3rd February 1906, 182) was first seen in August.

When the face is spotted with white, there may be in extreme cases a white forehead (Gunn, *Zoologist*, 1866, 385); "face pure white" (Bury, *Zoologist*, 1844, 789); or the head, ears, and part of the neck white or grey (Clark-Kennedy, *Zoologist*, 1869, 1558). A breed of white-faced hares was reported from Lincolnshire (Rudkin, *Field*, 12th February 1910, 290). In a specimen sent to the British Museum of Natural History by Heatley Noble, from Carradale, Argyll, on 15th January 1907, the white spots, often found in other specimens at the bases of the ears, meet at the nape, and the stripes from nose to ear are white, as they are also ordinarily in some Continental sub-species (see R. L., *Field*, 2nd February 1907, 183). So many individuals possess a white spot on the forehead that a belief has arisen that this indicates a buck, or one of a litter of four (see Cornish, *Field*, 14th May 1892, 704); as stated above, Drane considers white spots on the face a mark of age.

Pied, skewbald, or mottled specimens occasionally occur, the legs, feet, back, or sides being affected (see Clark-Kennedy, *Zoologist*, 1869, 1558; Whitaker, *Zoologist*, 1887, 233; Nicholls, *Field*, 12th April 1888, 547; Hunt, *Field*, 5th October 1895, 590; Tegetmeier, *Field*, 14th October 1899, 640).

There is a remarkable **grey variety** of both sexes, which has often attracted attention, and which appears, at least in all thoroughly authenticated instances, to have been observed only in autumn and winter (specimens examined were killed between 6th September and 22nd January). In this the normally ochraceous annulations of the hairs are white, and throughout the body white replaces brown or rufous of any shade wherever these occur in typical examples, and, in extreme cases, there is lightening or reduction of the black portions of the coat. This form has been recorded from, amongst other counties, Ross-shire, Ayrshire, Oxford, Bedford, Berkshire, Suffolk, Dorset, Norfolk, and in some districts would appear to be well known. Thus one or two are said to occur nearly every season in Norfolk (Gunn, *Zoologist*, 1866, 385; see also *Encyc. of Sport*, 1897).

This grey variety is strongly reminiscent and suggestive of winter whitening, a process which occurs regularly in some of the Continental sub-species of *L. europæus*. This fact, together with its prevalence in those parts of England which are coldest in winter, and its restriction to that season, suggest that it may be interpreted as a sporadic assumption of a white winter coat.

Local variation:—Hares vary in weight in different counties. Thus Cocks finds that on the Berkshire downs they are heavier than in Buckingham; in Orkney they are, according to Millais, darker and

heavier than either in Scotland or England; amongst Scottish specimens those from the Earn and Tay valleys attain great weights.

Woodruffe-Peacocke (*op. cit.*) believes that British Brown Hares can be divided into two intergrading sub-species; those of Scotland having a heavier, greyer coat in winter than those of the south of England.

Geographical variation:—*L. europæus* is a plastic hare, of which several sub-species have been recognised. In the typical form, which ranges from the Atlantic, except Britain, to Germany, and from Denmark to central France, the hind feet (including claws) run to about 150 mm., the colour is light and yellowish, and a pale winter coat is frequently assumed (= Nilsson's *Lepus medius*, 1820). The British form (*L. e. occidentalis*) is, on the average, not so heavy; its coloration is richer and darker, and it more rarely assumes a pale winter coat; both the above have whitish bases to the underfur. *L. e. pyrenaicus* of Hilzheimer, of the Pyrenees and south-eastern France, resembles the typical form, but is smaller, having hind feet measuring up to 135 mm. *L. e. corsicanus* of de Winton is about the same size as the last, but is yellower and has conspicuously buff bases to the underfur; it is found in Italy (Rome), whence it was introduced in classical times to Corsica and Sicily. *L. e. hybridus* of Desmarest (= *L. aquilonius* of Blasius = (?) *L. caspicus* of Ehrenberg), of eastern Germany to Russia and eastwards to Astrakhan, is a large light hare; the hind feet measure at least 165 mm., the cheeks are whitish, the rump buffy grey, and a grey winter pelage is habitually assumed. *L. e. transsylvanicus* of Matschie (= *L. e. transsylvaticus* of Hilzheimer), of inexactly known distribution from Roumania south through the Balkan peninsula to the Peloponnese, has the hind feet reaching 154 mm., and a bluish-grey rump strongly in contrast with the back; this form has been introduced into Denmark. *L. e. meridei* (Hilzheimer), a doubtfully distinct form found from south central and south-eastern France to northern Italy and in Corfu, is very like *L. e. europæus*, but its coloration includes more brown and less buff; it has a bluish-grey rump, not, however, contrasted with the back, as in *transsylvanicus*. Hilzheimer's *carpathorum* of the Carpathians is probably also distinct. Other sub-species may occur in Asia Minor, but they have not yet been studied. *L. europæus* certainly occurs at Trebizond.

Dimensions in millimetres:—

Skull (range of two males Nos. 95.1.19.1 and 98.2.11.1 in the British Museum of Natural History):—Occipito-nasal length, 94.2 and 97.4; condylo-basal length, 82.8 and 85.4; zygomatic breadth, 44.6 (both); breadth at inter-orbital constriction, 20.4 and 22; breadth at post-orbital constriction, 13.4 and 11.2; breadth of brain-case, 31.4 and 30.8; nasals (diagonal), 41 and 42.2; greatest breadth of both nasals

histories of very many others, which were formerly little known, have been fully elucidated, while, speaking generally, an immense increase in our knowledge on such important subjects as Migration, Distribution, Habits, Nidification, Plumages, has accrued: And lastly, a new and important branch of study has been instituted—namely, the recognition of the various Racial Forms or Sub-species exhibited by certain birds in the British Islands, on the Continent, and elsewhere.

A great advance has also been made towards a more satisfactory system of classification of the Aves—always a difficult subject—and this necessitates departures from the older views.

To bring this Standard Work thoroughly abreast of the most recent knowledge in all these departments is the object of the present work.

It should be remarked that while it is not intended to go fully into Synonymy, yet, where changes of nomenclature have been necessary in order to conform with the Law of Priority—the only method by which complete uniformity in nomenclature can ultimately be attained—the names used in the Fourth Edition of Yarrell's "British Birds" and in Saunders' "Manual," and the Trinomial Names of the British Racial Forms, and of those occurring in Britain as visitors from the Continent, will be quoted, as will also the Original Name under which the species was described.

In requesting Mr Eagle Clarke to undertake the duties of Editorship, the Publishers desire to make it known that they are acting under the advice of the late Mr Howard Saunders, who placed all his collected notes for a New Edition at Mr Eagle Clarke's disposal for this purpose. That Mr Eagle Clarke is eminently fitted for the work is well known to all who are interested in ornithological science. Through his investigations of the subject, and contributions to its literature, he has long been recognised as one of the foremost authorities on all that relates to British birds. He has studied our native birds in many portions of the British Islands, and has visited a number of bird-haunts in various parts of Europe in order to become acquainted in their Continental homes with the visitants that seek our shores.

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Member of the British Association Committee on the Migration of Birds as
Observed on the British and Irish Coasts, and Author of its Final
Reports, 1896-1903, etc.

With Numerous Illustrations and Maps

THESE studies, except those devoted to ancient and modern views, are the result of personal investigation for many years, during which Mr Eagle Clarke has enjoyed exceptional opportunities of acquiring special knowledge of the subject.

In 1884 the author was elected a member of the British Association Committee on the Migration of Birds as observed on the British Coasts; and on the completion of that great enquiry, he was requested to prepare the final reports on the results obtained—a task which he accomplished in 1903.

During the preparation of these reports (five in number), the author became much impressed with the advantages which were likely to accrue from placing a trained ornithologist at a number of the most favourably situated observing-stations. If this could be done, he believed that some of the difficulties which the phenomena presented might be solved, and our knowledge regarding the subject generally considerably advanced.

This conviction led him to undertake, by the special permission of the Elder Brethern of the Trinity House and the Commissioners of Northern Lighthouses, a series of personal investigations at various light-stations, each of which was selected for a special purpose. In all, Mr Eagle Clarke has resided no fewer than forty-seven weeks in these isolated and remote observatories; the stations visited being the Eddystone Lighthouse, the Kentish Knock Lightship (33 miles off the Essex coast), the lighthouses on the Flannan Isles and Sule Skerry (both lying far out in the Atlantic), and the lighthouse at Fair Isle (the "British Heligoland"). He spent twelve weeks in the autumns of 1910 and 1911 at St Kilda, for the purpose of carrying the investigations to the outmost fringe of the British area; and has also visited the Island of Ushant—an important station—and Alderney. A complete account of the birds of each of these remote and interesting stations, with special reference to their migrations, the times of their appearance, habits on passage, etc., is afforded.

Special attention has been given to the relations between migrational and meteorological phenomena, and the author has been fortunate enough to have had the study devoted to this important subject revised by Dr Shaw, F.R.S., etc., the Director of the Meteorological Office, to whom he is also indebted for a series of specially prepared Weather Charts, which add much to the value and interest of the chapter.

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A NEW AND REVISED EDITION OF
YARRELL, NEWTON, AND SAUNDERS'

HISTORY OF BRITISH BIRDS

EDITED BY

WILLIAM EAGLE CLARKE, F.R.S.E., F.L.S.

Keeper of the Natural History Department, The Royal Scottish Museum; Member of the British Association Committee on the Migration of Birds as Observed on the British and Irish Coasts; Corresponding Fellow of the American Ornithologists' Union; Corresponding Mitglied des Ornithologischen Vereins in Wien; Membre Honoraire du Bureau Central Ornithologique Hongrois; Member of the British Ornithologists' Union, etc.

ILLUSTRATED BY ORIGINAL COLOURED PLATES OF EACH SPECIES
SPECIALLY EXECUTED BY

MISS LILIAN MEDLAND

THE publication of Yarrell's "History of British Birds" was commenced in 1837 and completed in 1843. Its outstanding merits were at once recognised, and a Second Edition was called for in 1845, followed by a third in 1856.

From the issue of the Original Edition down to the present day, Yarrell's "History of British Birds" has generally and deservedly been regarded as the standard authority on British ornithology.

In the year 1871 a Fourth Edition was begun, under the masterly editorship of Professor Newton—the greatest British ornithologist of all time. Unfortunately Professor Newton's official engagements at the University of Cambridge only allowed him to complete the first two volumes; and in 1882 Mr Howard Saunders was selected to edit the remaining volumes, a task which he successfully accomplished to the entire satisfaction of ornithologists in 1885.

The many excellences of this last edition advanced the work more than ever in the public and in scientific favour. To its stimulating influence is to be mainly attributed the marvellous and unprecedented activity which has resulted in those extraordinary advances made in all branches of British ornithology during recent years—advances which have rendered it essential that a new work based upon this classical and comprehensive foundation should be issued.

During the period alluded to, a considerable number of new and interesting species have been added to our avifauna. The

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The English local names have been revised in part by Mr W. W. Skeat, M.A. (assisted by Professor W. W. Skeat), and in part by Mr C. M. Drennan, M.A. Lond., late Scholar Emm. Coll. Camb.; the Celtic and Gaelic names by Dr E. S. Quiggin, M.A., Ph.D., Fellow and Lecturer in Modern Languages and Celtic of Gonville and Caius College, Cambridge; while a list of Scottish Gaelic names have been supplied by Mr C. H. Alston. Valuable assistance has been rendered by Mr M. A. C. Hinton regarding extinct Mammals.

ILLUSTRATIONS

FULL-PAGE (*Coloured and Black and White*).

Mountain Hare, Stoat, and Weasel in Winter Pelage.

Feet of British *Leporidæ*: (1) *Oryctolagus cuniculus*, left fore foot, anterior view; (2) Ditto, posterior view; (3) *Lepus europæus occidentalis*, left fore foot, posterior view; (4) Ditto, anterior view; (5), (6), (7), (8) Left hind feet of *L. hibernicus*, *L. europæus occidentalis*, *O. cuniculus*, *L. timidus scoticus*, respectively.

Hind Feet (Left) of British *Leporidæ*: (1) and (5) *Lepus hibernicus*; (2) and (6) *Oryctolagus cuniculus*; (3) and (7) *L. europæus occidentalis*; (4) and (8) *L. timidus scoticus*.

together, 21.2 and 22.4; length of diastema, 27.2 and 27.8; length of mandible, 69.8 and 73.2; length of maxillary tooth-row, 18.2 and 17.8; length of mandibular tooth-row, 19.4 and 18.8 (continued on p. 268).

EXTERNAL CHARACTERS:—

	Head and body.	Tail.		Hind foot.		Ear.		Weight.	
		With terminal hairs.	To end of vertebrae.	With claws.	Without claws.	To notch.	To nape.	Lbs.	Oz.
MALES FROM NORFOLK :—*									
1.	595	89	..	151	..	101	128	8	8
2.	588	112	..	148	..	100	132	7	0
3.	585	96	..	152	..	100	132	7	8
4.	539	121	..	149	..	100	132	7	8
5.	535	85	..	147	..	102	129	7	4
6.	532	111	..	152	..	102	130	7	8
7.	540	120	..	149	..	102	132	7	10
8.	532	118	..	150	..	104	132	7	4
9.	542	110	..	151	..	100	130	7	0
Average of 9 Norfolk males	543	107	..	150	..	101	131	7	7
FEMALES FROM NORFOLK :—*									
1.	577	111	..	149	..	97	123	7	10
2.	590	112	..	147	..	95	120	7	12
3.	585	115	..	152	..	97	128	8	8
4.	520	90	..	152	..	97	128	7	8
5.	531	109	..	151	..	105	132	7	12
6.	520	94	..	148	..	95	115	8	4
7.	535	100	..	148	..	98	132	8	0
8.	534	111	..	150	..	100	128	7	6
9.	540	100	..	151	..	102	132	8	2
10.	538	110	..	150	..	97	125	7	10
Average of 10 Norfolk females	547	105	..	149	..	98	126	7	13
Average of both sexes from Norfolk	545	106	..	149	..	99	128	7	10
MALES FROM SCOTLAND :—†									
1. Strathora, near Perth, 29th Sept. 1911	520	..	95	146	..	90	117	7	14
2. Do. do.	527	..	98	147	..	92	120	6	10
3. Do. do.	514	..	89	147	..	92	120	6	10
4. Do. do.	549	..	98	159	..	95	127	7	9
5. Do. do.	530	..	95	140	..	92	124	6	11
6. Bridge of Earn, Perth, 6th Oct. 1911	533	..	98	146	..	92	124	7	10
7. Perth, 12th Feb. 1912	514	..	76	143	..	99	124	6	4
8. Do., 21st Feb. 1912	539	..	95	140	..	90	112	7	..
9. Do. do.	552	..	101	140	..	90	103	6	4
10. Do. do.	571	..	95	140	..	90	114	8	..
Average of 10 males from Scotland	535	..	94	144	..	92	119	7	2

* The Norfolk specimens were specially selected as fully adult, and measured by T. V. Sherrin, 10th February 1911, by kind permission of Messrs Kerry Brothers, Smithfield Market, London.

† The Scottish specimens were measured by A. M. Rodger.

EXTERNAL CHARACTERS (*continued*):—

	Head and body.	Tail.		Hind foot.		Ear.		Weight.	
		With terminal hairs.	To end of vertebrae.	With claws.	Without claws.	To notch.	To nape.	Lbs.	Oz.
FEMALES FROM SCOTLAND:—†									
1. Strathora, near Perth, 29th Sept. 1911	539	..	101	152	..	90	114	8	10
2. Do. do.	546	..	98	143	..	92	120	7	12
3. Do. do.	520	..	92	149	..	95	124	7	1
4. Do. do.	552	..	98	147	..	95	124	9	5
5. Do. do.	527	..	92	140	..	99	127	7	3
6. Bridge of Earn, Perth, 6th Oct. 1911	539	..	101	147	..	95	127	7	8
7. Do. do.	542	..	95	143	..	95	120	8	..
8. Do. do.	514	..	92	152	..	95	127	7	12
9. Do. do.	514	..	88	147	..	90	114	7	10
10. Perth, 12th Feb. 1912	539	..	95	140	..	92	127	7	..
11. Do. do.	533	..	76	149	..	92	127	7	6
12. Do. do.	539	..	101	152	..	99	130	6	..
13. Do. do.	552	..	83	140	..	90	114	8	..
14. Do. do.	574	..	98	152	..	102	130	9	..
15. Do., 21st Feb. 1912	546	..	89	146	..	95	120	7	12
Average of 15 females from Scotland	538	..	93	146	..	94	123	7	11
Average of both sexes from Scotland	537	..	93	145	..	93	121	7	7
MALES FROM VARIOUS LOCALITIES:—									
1. Just adult, Merton Hall, Norfolk, 28th January 1898 (Lord Walsingham, No. 98.2.11.1 of British Museum collection)	545	..	86	..	138	101	143	7	7
2. Norfolk, 15th Oct. 1911 (L. E. Adams)	570	..	..	150	..	..	..	7	15
3. Moorhampton, Hereford, 20th Nov. 1897 (W. E. de Winton, No. 3.1.26.1 of British Museum collection)	556	..	87	..	135	98	121	..	..
4. Hambleton, Bucks, 3rd June 1911 (A. H. Cocks)	533	136	79	139	..	82	130	..	..
5. Do., 11th June 1911 (A. H. Cocks)	482	120	70	..	113	85	120	..	..
6. Do., 22nd June 1911 (A. H. Cocks)	494	120	74	129	..	85	115	5	8
7. Ditto, juv., 26th Aug. 1911 (A. H. Cocks)	515	113	81	133	..	84	122	..	..
8. Surrey, 16th Oct. 1911 (L. E. Adams)	560	..	..	140	..	98	130	6	8
9. Grey variety, Tulloch Castle, Dingwall, Ross, and Cromarty, 29th Sept. 1903 (S. Dennis, No. 3.11.14.1 of British Museum collection)	540	..	72	..	136	99	..	..	..
10. Isle of Man, 17th Jan. 1895 (P. M. C. Kermode, No. 95.10.19.1 of British Museum collection)	530	..	76	..	132	102	..	..	..
11. Very young, 3rd Sept. 1906 (No. 6.9.18.1 of British Museum collection)	149	..	26	..	34	27	..	..	3½



MOUNTAIN HARE, STOAT, AND WEASEL IN WINTER PELAGE.

EXTERNAL CHARACTERS (continued):—

[illegible]

Skull (*continued*):—3 females, Nos. 98.2.11.2, 98.2.11.3, and 98.2.17.1, of the British Museum, the last being the type of de Winton's subspecies *occidentalis*:—Occipito-nasal length, 96.6, 98.2, 98.8; condylo-basal length, 86.6, 86.4, 87.4; zygomatic breadth, 45.4, 47.4, 45.2; breadth at inter-orbital constriction, 22.2, 20.4, 23.2; breadth at post-orbital constriction, 13.4, 14.4, 15; breadth of brain-case, 31.6, 31.4, 32.4; nasals (diagonal), 44.4, 42.4, 45; greatest breadth of both nasals together, 22.4, 21.2, 21.8; length of diastema, 28, 27.4, 26.2; length of mandible, 74, 75, 73; length of maxillary tooth-row, 18.8, 19, 19.2; length of mandibular tooth-row, 18.8, 20, 19.8.

The largest skull (sex unknown) in the British Museum (No. 97.3.8.1, from Vaynol Park, Bangor, North Wales) exceeds the above dimensions, so that they cannot be regarded as representing the maximum; the corresponding measurements are:—100.4—88.8—48.2—22—13.6—34.8—44.2—21—30—77.6—18.4—19.2.

Weight, in pounds and ounces:—This varies with the locality and sex, females being usually heavier than males, but the average for animals of both sexes in good condition is generally taken as 7 to 8 lbs., with a good number reaching 9, very few 10, and, rarely, higher weights. According to Millais, those from Scotland scale highest, especially from the Orkney Islands and the valleys of the Earn and Tay; but Harting finds Lincolnshire specimens unusually heavy. Exceptional individuals may sometimes be accounted for by introductions of continental races, or by their having been accidentally emasculated. A few individuals weighing over 13 lbs. have undoubtedly been killed, but some of the records mentioned below may not be reliable; all are, however, if correct, exceptional and noteworthy:—

Female, 10 lbs. 8 oz. (Laver); one, 10 lbs. 10 oz. (Monro, *Field*, 5th December 1874, 594); one, 10 lbs. 12 oz. (Chamberlin, *Field*, 14th February 1891, 215); one, 11 lbs. (Patterson, *Nature in Eastern Norfolk*, 318); two,¹ 11 lbs. 3 oz., on two occasions (*Field* editorial, 24th December 1887, 962); one, 11 lbs. 8 oz., near Doncaster (Nevile, *Field*, 23rd August 1873, 223); two, 11 lbs. 12 oz. (Mason, Lincoln, and Frost, Suffolk, *Field*, 10th November 1877, 545); three, 11 lbs., 11 lbs. 12 oz., 12 lbs., Murthly, Perth (Millais); one, 12 lbs., Mull, introduced (MacLaine of Lochbuie, *Ann. Scott. Nat. Hist.*, 1895, 250); one, 13 lbs. (Craven, *Field*, 1st January 1887, 14); one, 13 lbs. 1½ oz. (Jenyns, evidently from "A. B.," *Loudon's Mag. Nat. Hist.*, v., 1832, 276, a female sent to Leadbeater from Norfolk); one, 13 lbs. 4 oz.,

¹ It was probably one of these specimens to which Harting (*Encyc. of Sport*, 1897, i., 503) alludes as having been killed on the farm of Mr Tupholme, at Eastville, near Boston.

shot, October 1876, by Robert Henderson on the Longwitton Estate, near Morpeth, Northumberland (Hoskins, *Field*, 28th October 1876, 499); one of the same weight, mentioned in the *Field* of 24th December 1887, 962, was the same individual which is also noticed by the editor, *Field*, 1891, 215, and probably elsewhere; one, 13 lbs. 8 oz. (Kennedy, *Field*, 28th January 1888, 107); one, 13 lbs. 14 oz., killed by a keeper on the estate of the Misses Farringtons, Worden (J. T. H., *Field*, 14th December, 1878, 752, from the *Preston Guardian* of 11th December 1878).

Distinguishing characters:—The pale, dusky-tipped hairs of the underfur form probably the most diagnostic character at all ages as between the Brown Hare and the other three British species of *Leporidae*. Amongst adults, the long ears, reaching well beyond the nose, are unmistakable.

The skull-characters are given very fully on page 249.

The "timorous flying Hare"¹ has almost come to be regarded as the embodiment of speed and timidity.² Its prominent eyes and elongated, mobile ears are excellent organs for the discovery of danger, while the long, slender hind limbs are admirably adapted for the most rapid flight. And yet it is remarkable that hares should be so timid. They are at worst creatures of immense muscular power; armed with sharp claws and teeth, they possess considerable facilities of defence, as any one may learn who attempts to hold one. Had they the necessary confidence they would be no mean adversaries for the smaller carnivores, and, when tamed, they easily hold their own against the household cats and dogs.

Although in many respects resembling rabbits, there are as many differences in the habits of the two animals as in their structure. Whilst rabbits excavate burrows, whither if alarmed they instantly betake themselves, hares make only superficial depressions, called "forms."³ These they use only as resting-places, trusting to remaining motion-

¹ Shakespeare, *Venus and Adonis*; compare also such phrases as "More a coward than a hare" (Shakespeare, *Twelfth Night*, iii., 4); "Poor is the triumph o'er the timid hare"; and "The fearful hare," of Izaak Walton's *Venator*; and, for other instances, see above, p. 254.

² In this article use has been made of E. Adrian Woodruffe-Peacock's lecture, "The Cultivation of the Common Hare," being No. 7 of his *Rural Studies Series*; also of the "Fur and Feather" Series—*The Hare*; and the "Badminton Library"—*Shooting, Field and Covert; Hunting; Coursing and Falconry*.

³ Hence the printer's word, "forme."

less¹ for safety, and, when discovered, to speed and endurance.

A hare is at ordinary times a solitary animal, spending the day quiescent² in its "form," which it leaves in the evening to seek its food. Exceptionally, as when tempted by the rich repasts offered at harvest time, or during the sexual season, it becomes apparently gregarious; but the gregariousness is only superficial, and the members of the temporary party, if disturbed, disperse each on its own resources. Although as a rule restricting its excursions to a not very extensive area, there are times when a hare may travel long distances, one having been tracked for thirty miles in a night.³

Its tastes and appetite are capricious, and its wanderings lead it to some luscious field of clover, to the parsley of a kitchen-garden, to lie out on a salt marsh, or to sea-beaches, where, according to the late C. J. Cornish,⁴ the chief attraction is the wild sea-pea.⁵ But always it is ready for forays outside the shelter of the home pastures. Wander though it may, however, it is an animal of retentive memory, using the same tracks and sometimes returning to the same form for a long period. Unless very much frightened or otherwise losing its bearings, it restricts itself to a particular district, to which it always strives to return, no matter how sorely pursued. It exhibits a peculiar tendency to running along roads or railways. By means of these it sometimes strays so far as to lose itself, so that it fails to return. Sometimes it is surprised and cut to pieces by a train, and thus acquires a reputation for stupidity; but the very same act if undertaken before a pack of hounds is ascribed to special cunning. It is related that it did not appear in the mountainous districts of Lismore and Appin, Argyllshire, until after the construction of roads

¹ They are not really inconspicuous to trained eyes, unless, of course, when actually hidden by herbage. There used to be a profession made of hare-finding, see Peter Beckford, *Thoughts upon Hunting*, 121 and 127.

² According to Robert Collett the crotties of the Skandinavian Hare are usually dropped, one by one, in the morning after feeding and before lying down in the form; and Robert Drane's tame hares were so quiescent by day as not even to defecate. Drane states that anything extruded by day is passed into the mouth and swallowed (*Trans. Cardiff Nat. Soc.*, xxvii., ii., 1894-1898, 101-109, 1895).

³ Cuthbert Johnson, *Field*, 21st July 1883, 96.

⁴ *Shooting*, 1903, ii., 155-156.

⁵ *Lathyrus maritimus*.

had opened up communications with the low country ;¹ and it may have been in some such way as this that individuals have found their way into parks and towns, as described above on page 256.

The form soon takes on a rough oblong cast or print of the animal's body, with smooth sides and the floor trampled or scratched bare by the feet.² The shape is probably preserved by the occupant entering only in one direction, sitting quietly while at home, and, it may be, pulling the grass over it with its teeth. Thus it acquires a homely, warm, dry, and comfortable appearance, surprising when it is remembered that it is merely the space formed by the animal when lying down in a tuft of grass or other vegetation.

Forms, however, vary much in detail,³ for the animal changes its domicile at intervals, and its movements from one situation to another are usually attributed by writers to a capricious but doubtfully existent love of comfort. Undoubtedly hares are very hardy, and warmly clad with fur, and their wants were thus briefly summarised by a recent writer on sport :⁴—"They like dry ground beneath them, but are very indifferent to shelter ; it is a common thing to see a hare squatting on the side of a hill with the wind blowing into her fur. In this respect she is far less luxurious than the fox." The general opinion may be further stated somewhat as follows :—The hare does not like very thick coverts, nor those with a drip. In the summer it selects a shady spot, and in the winter an aspect where it may receive the warmth of the sun's rays. It is usually to be found in covert during rain, and in the open in fine, but not in very bright, weather ; there are days when, the season permitting, it must be sought for in

¹ J. A. Harvie-Brown, *Proc. R. Phys. Soc.*, Edinburgh, vi., 167, 1880-81, quoting from *New Statistical Account of Argyleshire*, 233. Thomas Pennant (*Tour in Scotland*, 1772, 102) has a similar note referring to the neighbouring districts of Glencoe, Glen Creran, and Glen Ety.

² Well described by Gervase Markham (*Country Contentments*, 4th ed., 1631, i., 34), with reference to its appearance as indicative of use and the probability of a hunt.

³ Beckford (*op. cit.*, 127) remarks that he had heard of a common practice amongst the shepherds on the Wiltshire downs of constructing artificial forms for hares to sit in ; and, when made on the side of a hill, it was possible to see at a distance whether they were occupied or not.

⁴ The Earl of Suffolk and Berkshire, *Encyc. of Sport*, vol. i., 1897, 559.

turnip fields, in stubbles, or amongst long grass and herbage; there are others when it affects naked fallows and ploughed fields. Sometimes it remains in its form,¹ close crouched until almost trampled on; it then lies wide awake and alert of eye, but with flattened body, fore legs drawn back, hind legs concealed, thighs prominent, and ears lying flat V-like on either side of the neck; at other times, especially when bad weather has made it wakeful, it is off long before a sportsman can approach within gunshot. As the hour of the natural evening emergence approaches it becomes wilder and more easily disturbed. In time of snow it often lies still until completely covered, and will not stir until compelled by hunger;² or it may sit at the end of a tunnel in a snow-drift.³

The demeanour of a hare when startled in the open is strikingly different from the low, crouching attitude which it generally adopts when in its form. On hearing an unusual sound, its first impulse is to sit upright with erected ears and reconnoitre; afterwards it may endeavour to conceal itself by squatting close to the ground, by skulking away with depressed ears, or it may at once take flight. As a rule the alarm is only partial, and the hare gallops off, holding itself well in hand, its rump thrown high at each leap by the spare driving power of its long hind legs; its ears are widely open, erect, and pricked forwards; its eyes, which are set so far apart as to see separately, observe only backwards. Should the danger not be considered serious, the animal may again halt, stand up erect on its hind legs, and at intervals continue its progress to the shelter of some covert.

If really frightened, the animal goes away at its best pace, wasting no time in looking about it; but it is only as a last resource, as on the near approach of a brace of hounds, that it closes down its ears along its back—a sign that there is no time to observe aught but the terror to the rear—and prepares to

¹ There is a vivid description in classical Greek of a hare lying at rest in her form, in Xenophon's *Cynegeticus*, v., 10.

² H. E. Forrest notes that in the Bala district of North Wales many hares perished in the severe frost of February 1895 (*Fauna of North Wales*, 57). Sometimes the animals become so encumbered with frozen balls of snow in their hair as to be easily captured.

³ Richard Kearton, *With Nature and a Camera*, 1898, 176.

do its utmost to save its life. At such times it is all compactness and entirely lacks the appearance of length which is at other times noticeable. Its habit of running "with its eyes behind it"¹ has been known to result in collision with dogs, men, bicycles, cattle, trees, or a member of its own species,² with unexpected and fatal results. So sharp is the creature's hearing that Richard Blome³ notes that of old when warreners wished to prepare hares for the market they filled their ears with wax; the idea being that when not continually disturbed by noises, the animals are quiescent, and grow sleek and fat.

The short tail may be carried bent over the back like a rabbit's, or it may be pointed straight backwards; countrymen and keepers profess to distinguish males and females by the attitude of this organ. That it has attracted attention from very early times is shown by a remark of "The Master of Game"⁴ that "An hare that crumps her tail upon her rump when she starteth out of her form as a coney (does) it is a token that she is strong and well running."

As part of its ordinary routine the Common Hare never enters a burrow like a rabbit, and trusts entirely to speed to escape from its enemies. But, if hard pressed, it will occasionally seek concealment under ground,⁵ and where these animals are preserved in numbers for coursing, it is customary to provide them with artificial escapes, usually entered by drain-pipes, in which they are trained to seek sanctuary.

As stated above (p. 169), a hare's gait is peculiar. Owing to the length of its hind legs the animal is believed to

¹ The old idea was that foxes hear from above, polecats forwards, hares backwards (*vide* an old writer quoted by W. B. Daniel, *Rural Sports*, 1801, i., 286); *i.e.*, foxes catch their prey by stealth, polecats by pursuit, but hares are always pursued. This is supported by the direction of the bony external openings leading to the internal ears, as pointed out by W. Farrar, *Loudon's Mag. Nat. Hist.*, iv., 1831, 9.

² For an account of a collision between two hares, see E. T. Booth, *Field*, 6th October, 1883, 490.

³ *Gentleman's Recreation*, 1686, pt. ii., 95. As in other nocturnal animals, the whiskers, which are very prominent, probably function as organs of touch, especially by night. Drane observed their use as such in his pets (*op. cit.*, 107). But the ears and external nasal apparatus are always twitching and on the *qui vive*.

⁴ Anno 1406-1413, ed. W. A. and F. Baillie-Grohman, 1909, 17-18.

⁵ References are hardly necessary for such a well-known fact, which was known as well to "The Master of Game" as to twentieth-century naturalists; see, however, E. W. H. Blagg, also Reginald Graham, both in *Field*, 15th February 1896, 258.

be at its best when going uphill, and is said to be obliged to run diagonally in descending a steep bank to avoid overbalancing itself, and, if such a course can be escaped, rarely to run downhill before hounds.

As regards the length of pace, a friend of Mr Forrest's has supplied measurements taken on snow, from hind foot to hind foot varying between about 7 feet 6 inches (90 inches) and 8 feet 9 inches (105 inches). In view of Mr W. D. Dovaston's note of the 15-feet¹ leap of a hare from the hiding-place of her young, taken in conjunction with the observations alluded to below,² there can be no doubt that much longer distances are frequently attained.

A good instance of leaping power in another direction was placed on record by Mr Alexander E. Parker,³ who saw a hare clear a wall seven feet six inches in height.

The animal has the reputation of possessing much cunning and of being the master of many wiles whereby to hoodwink its enemies. Mr Kearton,⁴ for instance, describes the deceptive way in which it enters its form,⁵ but it is probable that the cleverness has been exaggerated,⁶ especially by the older writers misinterpreting exceptional incidents or excited by pure imagination. An animal which, ever since the dawn of literature, has lent itself to pursuit or capture in so many forms, and thus to constant observation by a host of sportsmen—not always a very accurate class—very naturally becomes a centre for legends. Amongst the artifices attributed to it by the old French writer, Jacques du Foilloux,⁷ are the recognition of the hunter's horn, on hearing which one is said to have run towards a pool at a considerable distance, plunged in, and swam to some rushes in the middle, where it lay concealed. The thoroughly authenticated manœuvres of a hunted hare include

¹ Below, p. 287.

² See under Irish Hare.

³ *Field*, 15th February 1896, 258.

⁴ *Op. cit. supra*, 176.

⁵ " . . . With step revers'd
She forms the doubling maze ; then ere the morn
Peeps thro' the clouds, leaps to her close recess."

WILLIAM SOMERVILLE (1692-1743), *The Chase*, Bk. ii.

⁶ Ernest Thompson Seton rates the hares of Manitoba as stupid animals.

⁷ *La Venerie*, 1561.

doubling back on its tracks,¹ and then leaping off at right angles to start in another direction; entering an outhouse or other building, or lying down in the herbage or ivy on the top of a wall; and Mr J. S. Gibbons² has known one to run along the top of a wall so as to throw hounds off the scent, and also to lie down beside a fresh hare,³ apparently in the hope of shifting the chase to that animal. But, these incidents apart, the activity of the animal, its marvellous powers of leaping and dodging when under pursuit, the value of its flesh as food, and, lastly, its abundance, form a combination of characters so admirable as to require no exaggerated praise. It is not, indeed, surprising that it is still so honoured by sportsmen that the compassing of its end now attracts more attention, and is accomplished with more ceremonial, probably, than that of any other creature except the fox. Similarly, its welfare and preservation have for centuries engaged the attention of Parliament, the result being a long series of Acts, the last of which has probably not yet seen the light.

The pursuit of hares for sport by packs of harriers⁴ or a brace of greyhounds is probably as popular in Britain as ever. In the case of harriers, puss, although vastly inferior to her⁵ pursuers in powers of endurance, is, under fair conditions, their superior in swiftness. The quarry's chance of saving her life is inversely proportional to the size, and consequently the speed of the hounds used. According to Mr Paget, with smart twenty-inch⁶ hounds, having good noses and pace, the odds are as much as five to one against a hare, and if assisted by the huntsman, "a perfect pack of harriers should kill every hare they find."

¹ Often observed, as by J. O. Paget, *Hunting* (Haddon Hall Library), 1900, 259, but seldom analysed from the point of view of the hare, which may sometimes "run her foil" or "lay her maze" prompted by no more subtle feelings than those of indecision and, perhaps, of confusion.

² "Fur and Feather" Series, *The Hare*, 221.

³ J. C. Walter, *Stray Leaves of Travel*, 1910, 177-178, when hunting with beagles, observed an exhausted hare turn out a fresh one and herself lie down in the form just vacated. Paget (*op. cit.*, 257) believes that hunted hares intentionally squat beside fresh ones, and that commonly. He has known one to run along a road for two miles.

⁴ A word apparently connected with the verb "to harry" rather than with "hare."

⁵ Hares are usually mentioned in the feminine gender by coursing men (above, p. 252).

⁶ *I.e.*, height at shoulder.

But, with beagles not exceeding fourteen inches, the odds are three to one on the hare. There is a tendency to use small foxhounds for hare-hunting, and then the hare is soon outpaced, becomes bewildered and succumbs, whereas if she is not too closely hustled, she has time to exercise her wiles in a legitimate manner.

In coursing, the hare depends for safety on its power of sharply turning; in mere speed alone, unless favoured by slippery ground, as on hillsides or in times of snow, it is always very inferior to fresh greyhounds.¹ These are used in pairs and are released, or "slipped," from a leash so as to race side by side at full speed to their hare, which turns to one side just before the pursuers reach her, and they shoot onwards, so that she gains ground and time. During the "course" puss contrives to save her life for the moment by "turns" right about or "wrenches,"² but is ultimately caught unless she has time to reach covert. A single healthy hare will usually by its endurance and doubling tire out a single greyhound, and in natural country has a fair prospect of getting away from a pair of dogs, very rarely from three; but in the bare fields of an enclosed and artificial meeting she has but little chance³ of eluding two picked modern greyhounds unless artificial "escapes" be provided for her. On the other hand, in the spring and on suitable going, individuals are often encountered which are capable of running dogs to a standstill, especially if well (and artificially) fed after a spell of fine weather. I have seen a "bagged" Irish Hare on strange and perfectly open ground defeat every effort of two good greyhounds to catch her until they were thoroughly exhausted and gave up the chase; and

¹ The slowest greyhound also can easily overtake a fox.

² *I.e.*, changes of direction amounting to a right angle, but not right about like a "turn." The value of points in a course and the method of judging will be found in *The Hare*, cit. supra, 155, etc.

³ Hence, probably, the (at one time well-known) lines of Somerville's (*op. cit. supra*, Bk. i.) :—

" . . . nor the tim'rous hare
O'ermatch'd destroy, but leave that vile offence
To the mean, murd'rous, coursing crew; intent
On blood and spoil."

But in most reputable modern coursing meetings "escapes" are provided, if only for economy of the stock of hares.

Mr Charles Richardson once witnessed, but not on a single day, the running off of twenty-seven courses without a single kill; this was in Durham on a thin covering of snow rendered slippery by an overnight frost turning into a thaw.¹

As the greyhounds always run at their very best pace, the most remarkable feature of the sport is, apart from the high speed, the quite short time occupied by each course. The mere "run up," *i.e.*, counting from the moment of slipping till the quarry is overtaken, is accomplished with almost lightning-like rapidity. The remainder of the course lasts but little longer. It is said that the three final contests of the famous Waterloo Cup, the blue ribbon of the coursing world, occupied in 1889 no more than forty-nine, twenty-eight, and eighteen seconds respectively.² The first may be considered quite long, the latter comparatively short, but courses of both longer and shorter duration occur frequently.³

The excitement and uncertainty of coursing has been nowhere more vividly portrayed than in the following sentence from *The Noble Arte of Venerie*:⁴—"It is a gallant sport to see how the Hare will turne and winde to save hyr selfe out of the dogge's mouth. So that sometimes even when you thinke that your Greyhounde doth (as it were) gape to take hyr, she will turne and cast them a good way behind hyr: and so saveth hir self by turnyng, wrenching, and winding, until she reach some covert and so save hyr life."

It is when running before harriers that hares give examples of their powers of endurance in another direction. The "Master of Game" was pretty near the mark, as regards the average endurance of the animal, when he wrote:⁵ "A hare shall last well four miles or more or less, if she be an old male hare." But in February 1789, in Essex, one is stated to have covered more than twenty miles in two hours.⁶ Another, started on Stoke Down, ran, as "it was supposed, . . . near fifteen miles in three-quarters of an hour."⁷ The older records were, no doubt, exaggerated, but there are plenty of modern examples of straight runs exceeding five or six miles, without, so far

¹ *The Hare*, cit. supra, 124, 128, 130.

² "White Flag," *Irish Field*, 20th February 1899.

³ See under Irish Hare.

⁵ *Op. cit.*, 15.

⁶ Daniel, *op. cit.*, i., 330.

⁴ Anno 1575, 246.

⁷ *Ibid.*, loc. cit.

as could be ascertained, any change of quarry.¹ All these may be regarded as exceptional, and indicating that the hunted animal had "lost" itself. Unless hard pressed it will not leave the district in which it lives and which it therefore knows, but will continue to run in circles, as described above.

One feature of the hare's character, her obstinacy, is often brought out when efforts are made to drive her past a slipper or in any direction against her will. Timid though she is rightly described, it is yet sometimes impossible to drive an unwilling hare, which will again and again face a line of beaters, or even run through an excited crowd of yelling spectators, in order to break back to the region of safety. The same aspect of her character causes her, as stated above on p. 170, to affect certain beaten paths or "trods," which are often the means of her undoing, since they afford an opportunity for the setting of "snares." These are nooses of thin but strong twisted brass wire, firmly pegged into the ground at one end, and so placed that "puss" runs her head through them before she sees them. Since she never attempts to withdraw, the noose closes on her neck and she is held until suffocated. The trods of a hare are not so straight as those of a rabbit, and she prefers to find a way through or round rather than to jump an obstacle.

Although coursing and hunting still flourish as sports, the kindred sport of hare-shooting is growing less popular with keen sportsmen, and is by many regarded as cruel. The animal offers too big a mark to really afford a severe test of skill, unless at such a distance that she may be killed outright by a shot in the head. At all other ranges the so-called sport is mere butchery, and one who has inadvertently wounded a hare is confronted with a sight so pitiable and distressing as to haunt the memory from the beginning to the end of the day.²

Although capable of swimming well and taking to water readily when pursued, it cannot be said that hares living in a dry country habitually bathe for pleasure. But if accustomed to water, as when bred near the banks of a river, they "take to it like otters,"³ and may cross more or less formidable streams,

¹ G. H. Longman, *The Hare*, cit. supra, 188; J. S. Gibbons, *op. cit.*, 217.

² Sir Ralph Payne-Gallwey, Bart., *Shooting*, cit. supra, 10.

³ Earl of Suffolk and Berkshire, *op. cit.*, i., 560. For description of the swimming in *Leporidae*, see above, p. 224.

or even lakes, in search of food. A field of carrots has lured numbers over the Trent, where it was about two hundred yards wide,¹ and probably the attractions of a mate may transform any robust male into a Leander. So many instances of apparently spontaneous swimming are on record,² that particulars of one or two will be sufficient. William Yarrell found one crossing an arm of the sea about a mile in breadth,³ and in Scotland H. D. Graham⁴ often encountered them on little islets lying a quarter of a mile from the mainland, while the late Rev. John Atkinson stated long ago⁵ that on the saltings of Essex⁶ the hares lie in their forms until overtaken by the tide. Many similar instances have been placed on record.⁷

A hare is as exclusively a vegetable feeder as any known animal. Its food consists of various kinds of herbage, particularly of the mixture known as "grass"; but its choice is much more restricted than that of the Rabbit, and it is said to select comparatively few plants. According to Mr Woodruffe-Peacock, it much prefers the hard fescue, and, after that, the common meadow and the blue heath grasses. Of clovers its favourite is the true cow-grass or marl clover, and on open arable lands it seeks sow-thistles, dandelions, and chicory. In a garden it will attack, before all other plants, dahlias, pinks, carnations, and nasturtiums, parsley, lettuce, and thyme. It will eat also turnips, cabbage, and carrots. To young plantations or shrubberies it is a very annoying and destructive invader, gnawing off the bark and biting the tender young boughs; it seems to have a particular liking for conifers, but, amongst other trees, rhododendron and alder seem to be proof against it, while laurel is very attractive. The leaves of roses and laburnums were the favourites of Mr Drane's⁸ "No One," which had tastes

¹ Woodruffe-Peacock, *op. cit.*, 13; see also Drane, *op. cit.*, 106.

² See Harding Cox, *Field*, 22nd September 1906, 540.

³ *Loudon's Mag. Nat. Hist.*, v., 1832, 99.

⁴ *Birds of Iona and Mull*, ed. J. A. Harvie-Brown, 1890, 72.

⁵ *Zoologist*, 1844, 420. ⁶ Cf., for rabbits, E. T. Booth, *Field*, 6th Oct. 1883, 490.

⁷ As *Field*, 1889 (many references); F. Newbolt, *Journ. cit.*, 18th October 1890, 599; W. L. Distant, *Zoologist*, 1904, 187.

⁸ *Op. cit. supra*, p. 270; also MS. per T. W. Proger.

different from those of her successor—and cinders were also eaten. The record by Mr George Mawson,¹ that the stomach of a hare killed in winter contained a number of haws, is probably exceptional, as is a similar one in regard to holly berries.² Mr Woodruffe-Peacock states that when in good health hares swallow enough moisture off the grass to quench their thirst, but when sick they are great drinkers at ponds or streams.

The pitiful screech of a wounded or frightened hare is well known, and has been likened to the cry of a child; the horror of hearing it has caused not a few sportsmen to give up shooting these rodents. But, apart from this penetrating scream of anguish, few people appear to have heard their voice, and most naturalists credit them with being very silent mammals. If this be the case, it is probable that the silence is due not to inability but choice, for the Irish Hare possesses no contemptible vocabulary, and it is unlikely that in this respect it is inferior to its larger relative.

Besides their cries of pain or distress, hares are capable of uttering other sounds. Inasmuch as these are seldom heard³ and are known only to close observers, it seems well to quote freely from the few writers who have described them; their accounts do not agree in all respects. Mr Drane,⁴ after many years' experience of tame hares, distinguishes the cry of sudden fear from that expressing pain. Both sounds are emitted with open mouth, and resemble the word "annt" or "aunt" reiterated. Mr Drane believes that this is the only open-mouthed voice of the hare. But it utters with closed mouth other sounds or grunts having a variety of meanings, and which resemble the human "don't," "ōōnt," and "ōnt." Mr Drane could always make his pets say "don't," by threatening them with a quick movement of the hand, as if to seize them suddenly, they being so tame as to know that no harm was

¹ *Zoologist*, 1867, 604.

² *The Hare*, cit. supra, 27.

³ Charles Darwin, for instance, remarks (*The Expression of the Emotions in Man and Animals*, 1872, 83) that "Hares and rabbits . . . never, I believe, use their vocal organs except in the extremity of suffering"; but in a note to Francis Darwin's edition of 1901, 88, the author is stated to have subsequently received information that hares cry to their young.

⁴ MS., and *Field*, 25th March 1905, 504.

threatened. The exclamation is clear but not loud, and, indeed, often only just audible. The same sounds were described by Cornish¹ as "a kind of grunting squeak," and by Mr Woodruffe-Peacock as a "snuffling grunt," which is the accompaniment of a fight—"a peculiar grunting and hissing sound, produced by the throat and lips together."

The guttural pipe of the doe and the minor key of her sucklings are noticed by Mr Woodruffe-Peacock as well-known sounds of evening and early morning where hares abound. These cries appear to have been first written of by Edward Jesse.² That of the dam he considered faint, and somewhat like the feeble bleat of a fawn; the leverets answer in still feebler tones. The mother's call has been mentioned also by Mr Drane and Mr Millais. The latter's information was obtained from a keeper, who informed his employer, Sir Richard Graham, that this peculiar cry—"something between a grunt and a whistle"—can be heard distinctly at a distance of three or even four hundred yards. According to this man, the doe follows the scent of her young just like a dog, and utters this curious call as she goes along, and a similar one when she wishes to summon her litter to her side. Mr Drane's description is slightly different, for he states that the expression "ōōnt" was emitted rather than uttered by his pet hares to their young when loose at night in his house; it was so very subdued that to hear it at all an observer must be at very close quarters. The discrepancy may have arisen from the natural differences between observation in a house and out of doors.

Mr Woodruffe-Peacock describes a warning sound produced by the grinding together of the teeth. It is passed on from hare to hare over a wide area, and puts every individual within hearing on the alert for danger. Its effect is like the stamping of the hind feet amongst rabbits.

There are also "the low and plaintive tones," as they have been called, of the amorous buck and doe, which, together with the sounds already described, are so well known in the

¹ *Op. cit.*, p. 156.

² *Scenes and Occupations of a Country Life*, 1853, 310, as pointed out by Harting, *Field*, 4th March 1905, 375; see also *The Hare*.

country to those who spare the time for quiet watching, that no one seems to have considered an accurate description of them worthy of being committed to paper. Otherwise a recent discussion on hare-calling, or "hare-sucking," as it is often called, would never have been deemed necessary. With the advent of modern firearms and the general decay of methods involving time and patience, hare-sucking has certainly fallen into disuse in England. But it is well known to gamekeepers and poachers, and the best proof of its existence is that hare-calls may be purchased at the present day from many gunmakers.¹ In March 1910, two men were convicted in the north of England for killing six buck hares by the use of such a call,² and the practice undoubtedly survives commonly amongst poachers in other localities.³ The bucks are usually enticed by an imitation of the cry of a doe, but it appears that the scream of a leveret in distress may also be used. Calling hares requires some little skill and a precise interpretation of the sound to be imitated. A blade of grass properly manipulated is far more effective than a purchased call used without knowledge, for hares seem to be more discriminating than rabbits, which can be attracted by very careless calling.

Outside Britain the calling of animals by imitation of their cries, is, especially in the sexual season, very prevalent. Hares are thus killed in Arctic America;⁴ in France, where, according to Mr Harting, the poachers make use of an ivy leaf; as well as, in former times at any rate, in Greece.⁵ In North China, according to Mr M. P. Anderson, the Common Hare⁶ of Chefoo "is not wild, but will stop again and again if one whistles sharply." In Germany the cry of a suffering hare is used to attract foxes within gunshot,⁷ and experts

¹ As Westley Richards of Birmingham. A variety of calls for birds and animals were figured in the *Shooting Times and British Sportsman*, 26th Nov. 1910, 18.

² *Field*, 23rd April 1910, 733, where will also be found a summary of the printed information available in regard to the voice of hares and the use of the hare-call.

³ It is "common enough" (Woodruffe-Peacock *in lit.*).

⁴ E. A. Preble, *North Amer. Fauna*, No. 27, 1908, 200.

⁵ Richard Chandler, *Travels in Greece*, 1776, 128, records the slaughter of eleven thus called, including "a female big with young."

⁶ *L. swinhoei* of Thomas, see *Proc. Zool. Soc.*, London, 14th January (published June) 1908, 10.

⁷ Henry Scherren, *Field*, 20th March 1909, 510, and 27th November 1909, 974.

have learnt to imitate the voice of a leveret or the deeper notes of an old hare by blowing through their hands.¹

The instrument known as a hare-pipe has a somewhat interesting history. It is mentioned in statutes dealing with sport from at least the year 1389 to 1831;² and most writers on sport and natural history, as, for instance, William Bingley,³ appear to have taken it for granted that it was simply a hare-call, as described above. J. O. Halliwell, however, defined it as "a snare for hares,"⁴ and illustrated it by the following quotation:⁵—

"The next tyme thou shal be take ;
I have a hare pype in my purse,
That shall be set, Watte,⁶ for thi sake."

That Halliwell was right is shown by an entry found by Mr Walter Rye⁷ in the Court Rolls of Burnham, Norfolk, that in the 24th year of the reign of King Henry the Sixth (1445) certain individuals were presented for, amongst other things, using snares called "hare pypes." Again, in a Middlesex ordinance of 1512,⁸ prohibiting the capture of hares in nets or other engines called "Harpipes" until the Feast of St George (23rd April), the hare-pipe is compared with, but clearly distinguished from a net. Scherren⁹ drew attention to an old description of a hare-pipe,¹⁰ which leaves no possible doubt as to its true nature. It was a noose, pegged at one end to the ground, and differing only from an ordinary snare in having a hollow stick or pipe of elder wood threaded on it, so that when a hare thrust its head into the noose and began to struggle, the pipe was drawn up to the throat, causing strangulation.

¹ Scherren, *Field*, 12th February 1910, 290.

² 13 Richard II., stat. i., c. 13, to 1 & 2 William IV. c. 32, when previous game laws were repealed (Harting).

³ See also E. D. Cuming, *Field*, 6th May 1905, 762, quoting from William Taplin's *Sporting Dictionary*, i., 394, 1803.

⁴ *Dict. Archaisms and Provincialisms*, ed. 6, 1904, 434.

⁵ *Op. cit.*, 406, under *Go-Bet*, from MS., Cantab. Ff. v. 48, f. 110.

⁶ An old name for a hare; see above, p. 253.

⁷ *Field*, 13th June 1908, 982.

⁸ E. T. Howson and G. T. Warner's *Harrow School*, 1898, 6.

⁹ *Field*, 1st April 1905, 557; 20th April 1907, 647.

¹⁰ By L. M. (= Leonard Mascall), in *A Booke of fishing with Hooke and Line*, printed by John Wolfe for Edward White, in Paules, 1590, 62, also figure.

There is no recent record of the use of such a snare, except the statement by Mr Robert Warren¹ that it was employed in County Cork, Ireland, within his memory, for the capture of rabbits, and was set, not in the open like an ordinary snare, but at the mouth of a burrow.

Hares do not pair, but breed promiscuously, the females when they are about four months old, the exact date depending on the date of their birth, but in any case before they are fully grown; definite and reliable observations are, however, a desideratum. The does are discovered and chased by the males by scent, often "to the point of utter exhaustion or death,"² and probably, like the cuckoo, dispense their favours with impartial polyandrisms. Thus are explained the proverbial combats of the enamoured males, and the strings of "mad" hares which follow their leader in the breeding season, Mr A. H. Cocks having seen seven bucks pursuing a single female.

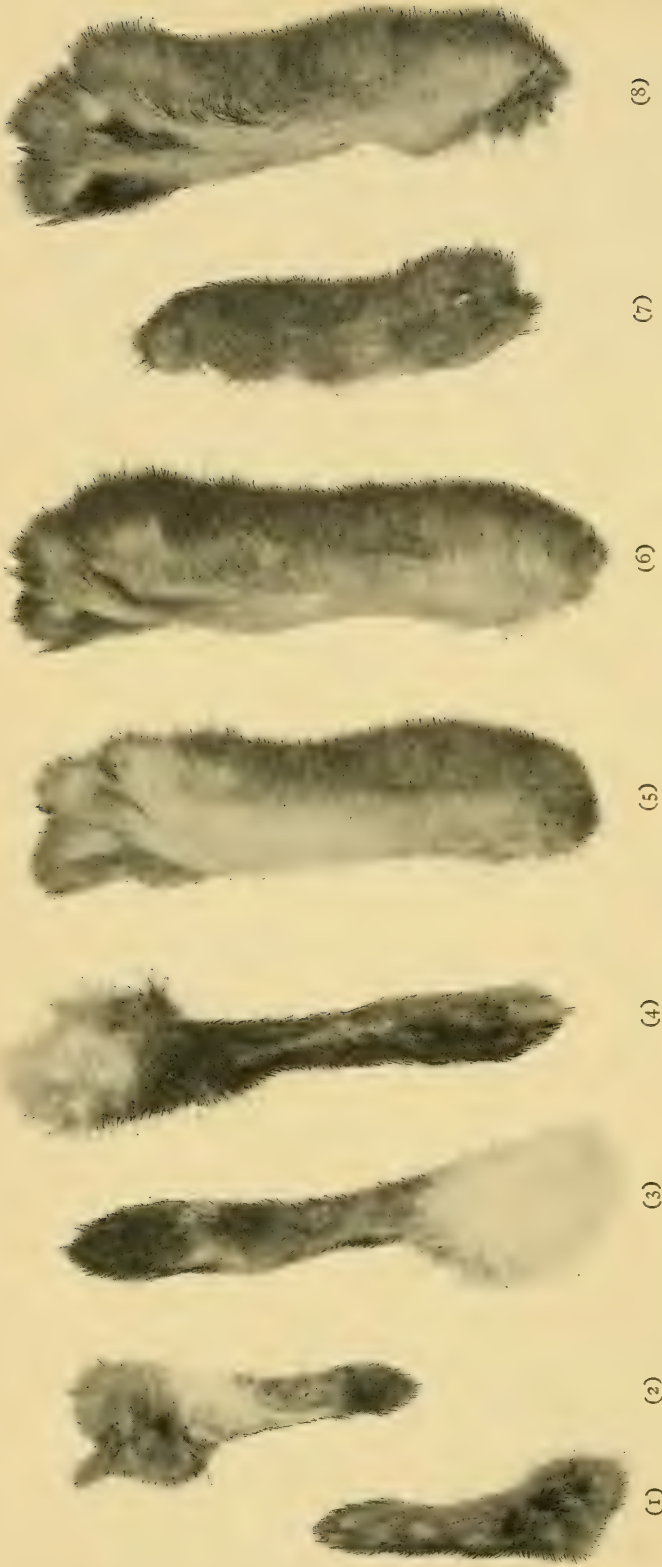
When in full rut, nothing could be more insane than the infatuated buck. His antics are often extraordinary, and include grunting, biting with ears thrown back like those of a vicious horse, kicking (as he jumps over his adversary, like a barn-door cock), bucking (strange, writhing, upright leaps into the air), and boxing with his rivals. It is true that such combats are rarely of a serious nature, and that they usually cease after March, although the sexual season does not; but for a time the fur flies freely, and Charles Waterton described a long contest which ended fatally for one combatant.³ Mr Drane was also witness of a savage and fatal affray, during which one hare jumped over the other and disabled it with a blow from its hind feet. It then turned round, sat up and played on the dead body with its fore feet, the strokes of which resounded like those of a muffled drum.⁴ A buck has been known to become so blind to the outer world as to pursue

¹ Who sent a specimen to the editor of the *Field*, 11th May 1907, 775.

² Owen Jones and Marcus Woodward, *A Gamekeeper's Notebook*, 1910, 57.

³ *Zoologist*, 1843, 211; another fatal conflict between two bucks is described by A. H. Beavan, in *Animals I have Known*, 1905, 59.

⁴ All *Leporidae* are facile with the feet, which they use a great deal to express emotions, anger or excitement being denoted by stamping; this habit will be found described in more detail in the article on the "Rabbit," see above, pp. 218 and 227, also 168.



FEET OF BRITISH LEPORIDÆ.

(1) *Oryctolagus cuniculus*, left fore foot, anterior view; (2) Ditto, posterior view; (3) *Lepus europaeus occidentalis*, left fore foot, posterior view; (4) Ditto, anterior view; (5), (6), (7), (8) Left hind feet of *L. kibernicus*, *L. europaeus occidentalis*, *O. cuniculus*, *L. timidus scoticus*, respectively.

All reduced, the actual lengths having been, as photographed: (1) and (2) 117 mm.; (3) and (4) 193 mm.; (5) 143 mm.; (6) 150 mm.; (7) 101 mm.; (8) 159 mm.

a dog in mistake for another hare;¹ and militants, perhaps of both sexes, when disturbed from their forms by cattle, have had the impertinence to strike the intruders on the nose with their paws.² A buck's demeanour, even when not absolutely "mad," always tends to be eccentric, and his excitable actions, sniffing of the ground, and usually in the rear position of a party, often betray him to an initiated observer.

As an instance of precocious pugnacity Cornish's account³ of a tiny leveret may be cited; it was one of five found together, and therefore new to the world, yet it repeatedly sat up and struck at a stick with its fore paws.

Although the term "mad as a March hare" fully expresses the popular idea of the commencement of the sexual season,⁴ this period in reality begins very much earlier, probably in November or December, waxes furious in March, slackens after May, but continues in milder form until July, when it ceases for the autumn. But young leverets have been found in every month of the calendar, so that the hare, which is evidently polyœstrous, may be said, locality and climate suiting, to propagate its species all the year round.

It is impossible to say how many litters are brought forth by each doe during the twelve months, but the fact that young may be found throughout the year makes it unlikely that there can as a rule be less than two or three.

The period of gestation is usually stated⁵ to be thirty days, which would be the same as that of the Rabbit. But, having regard to the distinction in size between the two animals and the marked difference in the stage of development reached at birth, it is probable that the period

¹ E. D. Cuming, *op. cit.*, 34.

² Cornish, *op. cit.*, 156.

³ *Op. cit.*, 157.

⁴ "The Master of Game" (*op. cit.*, 20-21), translating from Gaston de Foix, has some good remarks on the breeding habits of hares:—"The hares have no season of their love for, as I said, it is called ryding time, for in every month of the year that it shall not be that some be not with kindles [young]. Nevertheless, commonly their love is most in the month of January, . . . and from May unto September they be most slow, for then they be full of herbs and of fruits, or they be great and full of kindles, and commonly in that time they have their kindles. . . . A Hare beareth commonly 2 kindles, but I have seen some which have kindled at once sometime 6, sometime 5 or 4 or 2" [error for 3].

⁵ *E.g.*, by E. R. Alston (in Bell), MacGillivray, Jenyns, Blaine, Bingley, etc.

of forty-two days mentioned by some writers is more nearly correct.¹

The young are born covered with hair, with the eyes open, and are capable of running² soon, if not immediately after birth. No special nursery is prepared, nor does the mother pluck down from her underside, as do the Common Rabbit and the Snowshoe Rabbit³ of North America. When newly born the whole litter may be found huddled together, often with the mother. But this is only for a very short time; soon each squats in a miniature form by itself. At night they are ministered to by their dam, but whether she takes the active part in their dispersal, described below by Mr W. D. Dovaston, or whether they scatter naturally and of their own initiative, is still a debatable question. Probably, also, once the shelter of darkness has fallen over them they do not wait for their mother to visit them; at all events, young levèrets, if taken to a house, are very active at night.

Superfœtation must be rare, as it is difficult to obtain satisfactory evidence of it; and in some cases the facts may be explained as indicating only delayed development. A doe described⁴ by Dr Cuthbert Johnson contained two lots of young; a single one with hair and open eyes, and three others bald, pink, and about the size of full-grown mice. Captain Mayne Reid writes⁵ of another doe suckling two sets each of two young, but of different age, at the same time; but as the incident was not observed by himself, confirmation of the existence of such a practice would be desirable. Knowledge on these points is very meagre; but, if the period of gestation is forty-two days, if the young depend on their mother for three weeks, and if the doe, like the rabbit, pairs again shortly after parturition,⁶ then one litter should be off the dam's hands sometime before the birth of the next. If the period of gesta-

¹ Woodruffe-Peacock (*op. cit.*, 6) gives it as thirty to forty-two days; and T. Speedy, *Field*, 13th September 1902, 492, as forty-two.

² The mature fœtus measures 155 to 200 mm. to end of hind legs (Cocks, MS.).

³ *Lepus americanus*; see Thompson Seton, i., 631.

⁴ See above, p. 168; *Field*, 5th May 1883, 605; another instance is given by Speedy, *loc. cit. supra*.

⁵ *The Naturalist in Siluria*, 1889, 149-150.

⁶ This is the old, and probably correct, belief, dating at least from Aristotle:—"The female . . . after bearing submits immediately to the male" (*Historia Animalium*, ed. Thompson, vi., 33, 580^a, 3).

tion lasts only for thirty days, then one litter would run more closely on the heels of its predecessor.

Judging from the habits of the Irish Hare, the maternal feeling rapidly weakens, and D. P. Blaine¹ saw "what we believe to be the mother, driving a leveret or two away from her." For the short time² that the young remain with the dam she is an anxious mother, remaining in their vicinity, removing them in her mouth if discovered, and, if necessary, so far forgetting her timidity as to charge and drive away intruders. Mr G. Eames,³ then Master of the Cotley Harriers, Chard, vouched for an instance when a doe ran round a man who had picked up a leveret, grunting and stamping her displeasure until it was released; and Mr Walter⁴ relates that he was once charged three times by a hare, her conduct being explained by the discovery of a leveret lying a few yards away. The killing of a rook by a hare at Lockerbie, Scotland, was no doubt also due to a fit of maternal fury.⁵

An observation of Mr W. D. Dovaston's is that when leaving the young the doe makes one big leap, covering as much as fifteen feet when measured on the snow.

It is probably the early dispersal of the newly born leverets that has caused hares to be usually regarded as not very prolific animals.⁶ Most observers have met with small numbers of leverets together up to at most four; but larger litters of five, six, or even more, have been occasionally reported.⁷

¹ *Encyc. of Sport*, 1875, 508.

² Daniel (*op. cit.*) wrote that it would not be possible for the mother to suckle her young for more than a short time, or her udder would be too big. Whether this suggestion be true or not, it is obvious that the shortest possible suckling period would be the most satisfactory.

³ *Field*, 16th May 1908, 831; for a similar instance, see John Wilkes, *Field*, 22nd October 1892, 613.

⁴ *Op. cit.*, 177.

⁵ J. Cumming MacDona, *Field*, 2nd June 1883, 742.

⁶ In order to survive a hare *has* to be prolific, for all carnivorous beasts and birds kill it or its leverets when they get a chance, and, except in defence of its young, the idea of resistance never seems to enter its head. But Blaine's statement (*op. cit.*, 508), that a single pair enclosed in a walled garden had increased after twelve months to fifty-seven, is incredible, and evidently an exaggeration.

⁷ The following records of over five at a birth are worth preserving, but it would be too much to say that all are authentic—six in one form, Elchies, Strathspey, Elgin (Scotland), photo sent to editor by C. Harrison, *Field*, 8th December 1906, 991; six embryos, Norfolk, C. T. Robinson, on the authority of his father, *loc. cit.*; six, Kent, R. Pembroke, *Field*, 12th August 1893, 245; six (with exhausted mother),

The *Leporidae* attracted the attention of Herbert Spencer when elaborating a theory¹ to explain the relative degrees of fertility in the different races of men and animals. He believed that hares and rabbits illustrate the effects of different degrees of activity upon fertility, the two animals being similar in their diet, but unlike in their expenditure for locomotion. According to Spencer's information, the relatively inert rabbit has six young ones in a litter and four litters a year; while the relatively active hare has but two to five in a litter. That is not all. The rabbit begins to breed when six months old, but a year elapses before the hare begins to breed. These two factors compounded result in a difference of fertility far greater than can be ascribed to unlikeness of the two creatures in size. The value of Spencer's generalisation as compelling thought is not seriously impaired by reason of the errors in certain details; but its application in a wide sense to all mammals is problematical.

Some interesting observations were carried out by the late J. F. M. Dovaston, of West Fulton, Shropshire, who died in 1854, and whose description of the habits of the Water Shrew has already been quoted.² Unfortunately, although his experiments were continued by his son, nothing was published on the subject until Mr Forrest³ obtained an account of them from his great-nephew, Mr W. D. Dovaston, of Shrewsbury. The elder Dovaston kept a number⁴ of hares in the comparative freedom of a piece of grassland, enclosed with wire, near his house. The animals bred freely, and the number of young born at a time was found to be almost always five. Soon after birth the mothers were seen to take them one by one in their mouths and deposit them in separate places in the paddock, subsequently visiting them each in turn to feed them. Mr W. D. Dovaston is personally in a position

Hampshire, B. V. H. Forder, *Field*, 19th August 1893, 322 (found by C. Coote); six, photo of received from J. W. H. Grant, with *lit.* of 9th August 1906; seven, newly born, in one form, Gloucester, J. Garne, *Field*, 7th July 1888, 6; see also *Daily Mail*, 1st May 1906 (not seen, *fide* Millais); eight crouching in a bunch under a heap of hedge-trimmings, Owen Jones, *A Gamekeeper's Notebook*, 1910, 66; nine, "all of equal full size," Daniel, *Rural Sports*, iv., 1801, 695.

¹ *Principles of Biology*, revised ed., ii., 1899.

² Above, p. 137.

³ *Field*, 6th September 1902, 452.

⁴ The number of does is not stated, and W. D. Dovaston was* unable to enlighten Forrest on this point.

to vouch for the accuracy of the particulars, since, when a boy, he was in the habit of going round to find where the does had put the leverets. There is no reason to doubt Dovaston's observations, which have, indeed, been frequently confirmed both as to the number of young, and in respect to the doe carrying her young like a cat.¹ But Mr Forrest goes too far when he assumes that the number of leverets is always, or even most frequently, five. In fact, a no less weighty authority than Dovaston, the late J. C. Mansel-Pleydell,² laid it down that, although his keeper once found five together, three is the most usual number with vigorous mothers, but with old does only two, and with young mothers one; and these smaller numbers were verified by dissection. There can be little doubt that in the case of such prolific and flexible animals as the rodents, the number of litters and of the young in each must undergo considerable variation³ in accordance with the prevailing conditions of food, weather, and the health and age of the animals themselves⁴; Brehm states that the number of young in the first litter is one or two; in the second it may reach three or four; in the third, three; and in the fourth, one or two. It is probable that the number of leverets in a litter decreases proportionately with the number of litters produced by the dam in the year. The largest litters might, therefore, be expected in the north, where the climate reduces the length of the breeding season. This may explain why the species of hares inhabiting the barren northern districts of North America and Greenland commonly give birth to eight, nine, or ten young at a time.⁵ But in these northern hares the mammæ are more numerous than in the Brown Hare, so that they would have less difficulty in rearing a large family.

This species has now and then been kept as a pet, but must be taken young to become absolutely trustful. If kindly treated, it may then become so affectionate and confiding as to

¹ Editor of *Field*, 7th November 1891, 706; and 1st December 1906, 948.

² *Zoologist*, 1888, 259.

³ The variability is shown by Cocks's observation (MS.), that of seven pregnant females examined at Poynetts, near Henley-on-Thames, six contained a single embryo and the seventh five.

⁴ See on this point Preble's account of the American Varying Hare (*op. cit.*).

⁵ See above, pp. 160 and 170.

render the term captive inappropriate.¹ It has pretty, cat-like ways of cleaning itself, and is in every way a most engaging animal, full of life, activity, and inquisitiveness, but rather large for convenience, and requiring more space and attention than can be spared by ordinary people. In fact, the playful but boisterous habit of climbing all the furniture in turn, so that nothing was out of its reach, caused Mr Cocks to banish an otherwise delightful pet to an out-of-door cage; and one belonging to a lady of my own family met the same fate, owing to its aggressive attacks on strangers and its noisy nocturnal activity. Hares may be taught to play all sorts of curious tricks,² and to appear as performers in public shows. They will associate freely with, and are at least a match for, domestic cats and dogs,³ but often meet their end owing to attempted liberties with strange dogs, as did one which lived with a butcher in the town of Alloa, Clackmannanshire.⁴

The love of drumming mentioned above is highly characteristic, both of hares and of rabbits, which often sit upright on their haunches and vigorously vibrate their forearms, beating the air with a motion somewhat distantly resembling the action of a man practising boxing. There are frequent intervals in the performance, during which the paws are licked and cleaned, and one of them may be placed in a feline-like manner flat on the breast, palm inwards.

A classical instance of tame hares is that of the poet W. Cowper, whose description⁵ of the ways of his three pets, Bess, Tiney, and Puss, is still well worth reading, but is too long to transcribe. The three had quite different characters, and assumed a varying degree of tameness. One died soon after attaining maturity; the second reached nine years before succumbing, as was supposed, to an accident; but the third died of sheer old age at one month short of twelve years.

¹ The leverets may be reared on cow's milk, or suckled by a cat. Woodruffe-Peacock states that they require fairly coarse sand for grinding down their teeth (*op. cit.*, 13).

² E. C. Phillips, *Field*, 26th July 1902, 183.

³ C. Wapshare, *Field*, 3rd January 1891, 10.

⁴ P. Anderson Graham, *Country Pastimes for Boys*, 1908, 226.

⁵ *Gentleman's Magazine*, June 1784, 412; epitaph on "Tiney," *Journ. cit.*, December 1784, 935.

These three were all males, and were given no opportunity of breeding. As a matter of fact, hares are very infertile if kept in close confinement, but the reverse is the case if a small grass run is provided. Mr Drane's hares produced two litters, but they had the unrestrained freedom of his house at night. A pair confined in a small run measuring only fifteen by six feet produced young as follows: in 1901, three in two litters; in 1902, two in two litters; in 1903, four in three litters. In 1904 the doe hare died.¹

Mr Drane, who has written a most sympathetic and appreciative account² of his pet hares, states that they panted for pleasure like dogs, and, again, like dogs also, dreamt in their sleep. Some of their dreams must have been as unnatural as those of the human species, for they were accompanied by actions suggestive of burrowing,³ a practice to which they are little addicted when awake. Of the attitudes of the hare he writes, that "they are very striking and bewitchingly graceful. It will sometimes lie at full length on its side, with its head only erect, its hind legs stretched out to their full length. In this position its white underside, otherwise but rarely seen, is very conspicuous, and as the back may not then be visible, the creature looks mainly pure white, with *blue* or French grey ears, for the inside of the ear is very blue at times. It will romp and roll itself with infinite delight and sprightliness on a clean, white counterpane or table-cloth. Sometimes it will sit with its hind legs extended forward, so that the hind feet are in advance of the nose, when it looks as if it had four fore feet and no hind ones. Again, it will draw back its hind feet and extend its fore ones to their fullest length, and then its head seems to rise from the centre of the back. But perhaps the prettiest thing of all is to see it clean its ears. It puts its head on one side, pulls down its ear, and passes its two paws over it again and again most strikingly, like a lady dressing her hair.

¹ T. Thompson, *Zoologist*, 1904, 470. For other instances, see John Ditch, *Field*, 17th May 1890, 733.

² *Op. cit. supra*, p. 270.

³ In this point Drane may have been mistaken, since the motion of the hare's forearms may have been the result of thoughts other than of digging; there is no evidence that the ancestors of hares were burrowing animals; even in the case of the Rabbit the evidence is all the other way.

It can stand quite perpendicular, without support, upon its hind toes, and even advance some steps in that position, balancing itself by holding out its fore limbs horizontally. Its leaps are remarkable for their height, grace and agility. It habitually overleaps its object, and comes down upon it with a curved descent, as beautifully as an antelope, thus contrasting with the cat, which scarce jumps up to the necessary height, while the hare overleaps it. I question whether it ever *runs* with its hind legs. . . . Its ordinary habit is to walk and run with its fore legs, and only to hop with its hind.

“In its disposition it is pacific, trustful, and affectionate in a most touching degree when its heart has been gained, and indeed even when it has not. My hare will always lick my hand in response to a caress, and by the same habit silently appeal to me for protection in any apprehended danger, as the presence of a stranger, or of some person whom it distrusts or dislikes.”

The various methods of cooking hares' flesh would probably fill a fair-sized chapter in a volume on cookery, and have no direct concern with the present article.¹ It would, however, be hardly complete without allusion to two such celebrated dishes as hare soup and jugged hare. Colonel Kenny Herbert has written a delightful chapter on this at first sight unpromising subject, and it may be recommended to the curious.²

GROUP LEPUS.

An attempt was made by Lyon (see above, p. 229) to separate the American varying hares sub-generically, but the definition of his sub-genus *POECILOLAGUS* contained no absolutely diagnostic skeletal or other structural character. On the other hand, the varying or snow-hares of the Old World, together with *L. arcticus* and its allies of North America, form a natural and easily recognisable **group**, distinct not only in structure, but in origin and habits from the hares of the group *Eulagos*.

History:—Snow-hares have been occasionally alluded to at least from the time of Varro (B.C. 116-27), who described (*De*

¹ See Cocks, 171.

² *The Hare*, 231-262.

From above.

From beneath.



HIND FEET (LEFT) OF BRITISH LEPORIDE.

(1) and (5) *Lepus hibernicus*, reduced from 143 mm.; (2) and (6) *Oryctolagus cuniculus*, reduced from 101 mm.; (3) and (7) *L. europaeus occidentalis*, reduced from 150 mm.; (4) and (8) *L. timidus scoticus*, reduced from 159 mm.

Re Rustica, iii., xii.) the Alpine form, which Miller has appropriately named *L. timidus varronis*, in the following words:—"Alterius generis est, quod in Gallia nascitur ad Alpes, qui hoc fere mutant, quod toti candidi sunt," *i.e.*, "there is another kind, which is found in Gaul on the Alps, which make this change that they become totally white." They were also noticed by Pliny, who wrote in the first century A.D.; he mentioned their seasonal changes of colour, and stated that they eat snow for food. They are, however, said to have been regarded as rarities at Rome in the same century, and to have been brought into the circuses in the reign of the Emperor Nero (Keller, 213). In spite of the fact that they were specified as existing in the Orkneys in the twelfth and again in the sixteenth centuries (see below, under *L. t. scoticus*), they seem not to have been accurately known to zoologists until comparatively recent years; and this fact accounts (as shown above on p. 251) for the confusion which has arisen over the technical names of European hares.

Externally, these hares are **characterised**, as compared with *L. europæus*, by their relatively large head, prominent eyes, less highly developed olfactory apparatus and whiskers, shorter and narrower ears, shorter tail, longer limbs, especially the fore, and relatively larger feet. The coat is woolly, with distinct pattern of the underfur, and there are marked juvenal and post-juvenal pelages; the tail is wholly white, and there is a conspicuous spring moult. There are eight **mammæ**, of which a pair are pectoral and three pairs abdominal.

In the **skull** the brain-case is relatively broader and shallower; the frontal region is concave behind the nose, anteriorly less constricted and broader behind the superciliary processes, which are raised above the level of the skull in connection with the large eyes. As a result, the dorsal profile is not conspicuously arched, and barely rises above the anterior roots of the zygomata. The anterior portion of each zygoma is relatively deeper, the distance from the anterior termination of the groove on the outer surface to the front edge of the arch being less than the least depth.

In the **teeth**, the upper incisors are slightly narrower as well as straighter, and their roots extend beyond the premaxillo-

maxillary sutures, where they terminate in marked swellings on each side of the palate. The cheek-teeth are longer, the height of a posterior upper premolar, measured from crown to extreme upper point of the root capsule, within the orbit, being greater than the alveolar length of its tooth-row.

The **mandible** is characterised by its relatively large dimensions of height, a consequence of the more hypsodont teeth. Its inferior border is rounded, not sharp, and passes insensibly into the symphysial region.

The **scapula** is relatively wider, this feature being more marked in *L. hibernicus* than in *L. t. scoticus*. The tibia attains a much greater length than in *Eulagos*.

The group includes a number of forms of circumpolar **distribution** in Europe, Asia, and North America, but not occurring naturally in Novaya Zemlya, Franz Joseph Land (Bruce), Spitzbergen (Collett), Iceland, or the Faeroes. Two pairs from Norway were turned down in 1854-55 at Stromö, in the latter islands, and their descendants are stated to have increased so rapidly as to have numbered thousands after a very few years (Müller and Trevelyan, *Ann. Mag. Nat. Hist.*, December 1864, 461), and even to have supplied material for reintroductions thence to Norway (Collett).

The exact status of some of the described forms is uncertain, but they may for present purposes be regarded as of specific value; some, as *L. altaicus* and *L. hibernicus*, occupy mountains, or islands, where they are completely separated from their nearest allies. *L. altaicus* (Sanford, *Quart. Journ. Geol. Soc.*, London, xxvi., 1870, 127), described from the Altai Mountains, is a reddish-brown hare, resembling *L. hibernicus* in colour, but with the black ear-tip extending downwards to the base of the ear; *L. aimu* (Barrett-Hamilton), described from Yezo, Japan, has a large narrow skull, the occipito-nasal length of which reaches 97 mm.; Nordquist's *L. tschuktschorum*, of north-eastern Siberia, is even larger than the last, with occipito-nasal length of skull 103 mm.; Allen's *L. ghiciganus*, described from Ghiciga, Eastern Siberia, is smaller, tawnier in summer, and with less massive skull and teeth. Undescribed hares of this group occur in Sakhalin Island (see Thomas, *Proc. Zool. Soc.*, London, 1907, 414), as well as in the Stanovoi (see Allen,

Bull. Amer. Mus. Nat. Hist., New York, xix., iv., 31st March 1903, 157) and Khingan Mountains, Northern Manchuria (Thomas, *Ann. Mag. Nat. Hist.*, December 1909, 504).

There are two living **British species**, the Irish Hare, *L. hibernicus* and the Scottish or Blue Hare, a sub-species of *L. timidus*, the range of which latter, regarded as a species, includes all arctic Europe to an unknown point in corresponding latitudes in Siberia. In Norway it has, according to Collett, a wider distribution than any other game animal, being more or less frequent from the seashore to the edge of the snow on the fjelds; in the islands, however, it is unevenly present and apparently not native, though it usually thrives well where introduced, despite the attacks of its chief enemies, the sea-eagles and eagle-owls; it occasionally visits Denmark, by crossing the ice from Skåne in Sweden. In Finmarken it reaches the extreme north of the mainland, but is rare on the furthest coastline (Collett). In Russia it ranges south to 55° N. lat., and is found in West Prussia and Lithuania (Blasius). It has an isolated colony in the Alps (*L. t. varronis* of Miller), but has been incorrectly credited to the Pyrenean fauna (see Trutat, *Bull. Soc. d'Hist. Nat.*, Toulouse, xii., 1878, 110); there is a doubt also if it occurs in the Caucasus.

Distribution in time:—Although remains of hares are plentiful in British and west European deposits of late pleistocene age, all those that have been satisfactorily determined belong to some form of true *Lepus*; the group *Eulagos*, as has been already shown on p. 259, being entirely unrepresented. The varying hares were widely distributed in late pleistocene times, and ranged to the south of England, and in continental Europe as far south as Parignana, Italy (Forsyth Major, *Atti. Soc. Sci. Nat. Ital.*, xv., 390). They are thus shown to be older, and the brown hares newer inhabitants of the country.

Hinton showed that the fossil skulls from the late pleistocene deposits of Ightham Fissure, Kent (*op. cit. supra*, p. 259), belonged to animals resembling the Irish Hare, but distinguishable by larger size and robuster skeleton, characters shared by all other specimens from the English Pleistocene. Hinton could not unite any British specimens with fossil hares described from continental localities, the

latter either having other affinities, or being, like *L. diluvianus* of Pictet (*Traité Élémentaire de Paléontologie*, 1844, t. i., 207), too imperfectly known for purposes of comparison. Hinton therefore characterised the English pleistocene form of *L. timidus* as a sub-species, to which he gave the name of "*Lepus variabilis anglicus*." This hare appears to be the slightly less specialised precursor of our present stock of varying hares, standing in the direct ancestral line of *L. hibernicus*, and, if so, cannot logically be regarded as a sub-species of its own descendant. The better plan would seem to be to treat it as a species.

Evidence has recently been forthcoming to show that *L. anglicus* survived in England until historical times. A tibia from the Roman camp of Corstopitum in Northumberland (see above, p. 259) shows the characters of true *Lepus*, and has an extreme length of 152.7 mm., and an interarticular length of 146 mm., a size far exceeding that of any species now found in Western Europe, but agreeing closely with that of Hinton's Hare (extreme length, 154.6 mm.).

The institution of the group *Lepus* makes it possible to compare the hares of North America with those of the Old World which may be said to correspond roughly in their grouping. Thus *L. arcticus* and its allies fall naturally within the group true *Lepus*, while *L. callotis* and the black-tailed "jack-rabbits," though lacking the black ear-tips, resemble *Eulagos* in number of mammæ, in their long ears, their black tail, and, less closely, in pelage. Further, the genus *Sylvilagus*, including the New World cottontails, corresponds, as has been shown above, to a certain extent with the Old World *Oryctolagus*.

On the other hand, *L. americanus*, the "Snow-shoe Rabbit," and its allies, while agreeing in pelage and number of mammæ with true *Lepus*, stand alone in other respects and cannot be connected with any Old World group; and a second irreconcilable feature is presented by the white-tailed "jack-rabbits" of the *L. campestris* group, which are intermediate between *L. americanus* and *L. callotis*. Thus, although the various groups correspond to a certain extent, there are so many points of disagreement that it is not possible, except in the case of *L. arcticus*, to unite those of the Old and New

Worlds. There are, however, so many resemblances, albeit so dimly shown, that it seems safe to attribute them to ancestral divisions of great antiquity, which existed in the family before the separation of the two continents, and which have since been obscured by fresh developments in independent directions. This suggestion is borne out by the occurrence of *Oryctolagus lacosti* in the upper Pliocene of France and Italy, thus showing that the Old World *Oryctolagus* is more ancient than *Lepus*, and has existed as such from pliocene times, just as true *Lepus* is, locally at least, more ancient than *Eulagus*.

According to the above view, the American cottontails and the European rabbits may be regarded as two branches of one group, which stands nearer than any of the northern hares to the original ancestor of all the *Leporidae*. Their white flesh may be regarded as a primitive character, since the meat of leverets is lighter than that of adults; it is surely of importance in indicating affinity, but in other respects the two branches have developed to very different degrees. Thus, whereas the cottontails have acquired only to a limited extent the habit of burrowing, in rabbits the practice is almost invariable, but, as stated on p. 172, it is unaccompanied by any special modification in a fossorial direction, thus indicating that the art of digging has been acquired in comparatively recent times, in compensation for lack of speed and staying power. In all the *Leporidae* the power of consuming and digesting a comparatively coarse and innutritious food has been highly developed, and in this respect rabbits are in no way inferior to hares.

Status:—It has been shown above that the varying hares are a relic of an older fauna, hence they probably stand nearer their common ancestor than the brown hares. It is consequently not surprising to find them exhibiting certain resemblances to the still more ancient rabbits, namely, in their skull, their soft pelage, short ears, and even in their greater inclination to burrow a little. But, on the other hand, in every other aspect of their conformation they must be regarded as distinctly the most specialised British hares.

Winge (*Grönlands Pattedyr*, 1902, 358) finds specialisation in their comparatively regular assumption of a white winter coat. Hinton notes further specialisation in the narrower, stronger,

high-crowned molars, straighter upper incisors, more powerful masticatory muscles, and in the larger eyes, resulting in heightened superciliary processes¹ and peculiar curvature of the cranium. To the above features may be added the longer limbs, the shorter tail, complicated system of juvenal and post-juvenal pelages, and the greater number of mammæ, resulting in larger (in compensation for fewer) litters of young. There are only three points in which the Brown Hare appears to be the more specialised, namely, in its longer ears, more highly developed olfactory organs, and stronger whiskers. But it has been already suggested that this is only in compensation for its poorer sight, a combination characteristic of a nocturnal animal. Winge's suggestion that the short ears and shrunken nose of true *Lepus* are a result of a cold climate has no weight in the case of the Irish Hare, which has a southern habitat. Having regard to the short ears of the Rabbit, this particular feature is probably a survival of a primitive character.

The work of differentiating the various members of the group *Lepus* further shows that the southern forms, e.g., *L. hibernicus*, and, very markedly, the extinct pleistocene *L. anglicus*, are distinctly more primitive than the more northern, such as *L. t. scoticus*. Apart from their teeth, the humerus and forearm are in the former of approximately equal length, as seen also in *O. cuniculus*, whereas, in more northern forms there obtains the specialised arrangement, whereby, as in *L. europæus*, the radius is distinctly longer than the humerus.

The most specialised of all is *Boreolepus grænlandicus*, with its always white woolly coat, short ears, strong nails, and protruding incisors; an animal which by no stretch of the imagination could be regarded as ancestral to, or even older than, the British varying hares, especially since, as shown above, *L. anglicus*, the ancestor of the latter, is most nearly allied to the modern *hibernicus* and not to *grænlandicus*.

There is no evidence to show how the ancestors of the Greenland Hare reached their present habitat. They can

¹ Note, however, that in this case the elevation of the roof of the orbit is in some measure also due to mechanical raising by the longer roots of the more hypsodont cheek-teeth.

hardly have crossed over from Europe, since, as shown above, the Greenland Hare is not at all closely allied to any Old World species. It stands by geographical position farthest away from the centre of distribution of the whole family, and exhibits the highest expression of that specialisation which has its beginning in *L. hibernicus* and *L. anglicus*.

The origin of the varying hares of Britain, and the bearing of their present distribution upon former land connections, has engaged a considerable amount of attention. Most writers regard them as animals of northern origin which were driven south by the rigour of the glacial period. They suppose that, when the cold passed away, and their southern habitat became once more temperate, the hares returned north to their original home. A few isolated colonies remained behind; in mountainous regions, the severer climate of which is presumed to have suited them, and in Ireland, which is considered to have become an island before the close of the glacial period, thus cutting off their retreat. The above view is so plausible and at first sight explains so many of the facts, that it was until recent years very widely accepted; but latterly it has been subjected to considerable criticism. Thus Scharff (*Proc. Roy. Irish Acad.*, ser. III., iv., 3, 1897, 470-71; *European Fauna*, 1899, 315; *European Animals*, 1907, 39), while accepting their northern origin, which he further supports in *Distribution and Origin of Life in America* (1911, 10), pointed out that the hypothetical objection of the varying hares to a temperate climate cannot be the cause of their supposed preference for arctic and mountainous regions, since their Irish representative flourishes in a country of mild temperature and comparative absence of snow.¹ Accordingly he suggested that the Brown and Blue Hares are mutually antagonistic animals, the former and stronger of which has prevailed over the weaker. This is, so far as it goes, a reasonable hypothesis, and explains to a certain extent the distribution of the two groups, as it existed before man's interference.

It is no doubt correct to say that the varying hares of Europe and Asia form an ancient group not necessarily of

¹ Hinton (*Proc. Geol. Assoc.*, xx., 1907, 39, etc.) drew attention to a similar instance in the case of one of the snow-mice, *Microtus lebrunii* of Crespon.

northern origin, and showing no close relationship with the Greenland Hare. They are the descendants of animals formerly of much wider distribution. They may have originated, as Hinton suggests (*op. cit. supra*, p. 259), in Asia, possibly, indeed, in North America, but they have given way before the competition of more generalised immigrants of the same family, before which they have retreated to mountains, to the polar lands, or to isolated districts, where their strong teeth enable them to masticate the coarse herbage. The newer arrivals have not always had time or power to penetrate these districts, which are, besides, not always attractive on account of their severe climate and deficient food supply. This is shown by the fact that the Brown Hare thrives quite well in Ireland when introduced there (see above, p. 258), and more clearly still by recent events in Skandinavia. Brown Hares are not indigenous to that country, which they were evidently unable to reach owing to the intervention of the Baltic, but they have recently been introduced by sportsmen, and, according to Lönnberg, multiply and crowd out the native hares (see above, p. 237).

In the present state of knowledge it is difficult to attempt to explain how the Brown Hare ousts the Varying. Scharff (*Irish Naturalist*, 1898, 126) insists on the existence of "a spirit of antagonism" between the two groups, and such a spirit seems to be almost taken for granted by sportsmen who have both on their lands (see *Journ. cit.*, 1898, 69-76); but there can hardly be active antagonism, since the two species mingle freely, and even interbreed where their ranges overlap. Probably it is a simple case of "crowding out" in a straightforward struggle for survival of the fittest. The advance of tillage farming and the progress of deforestation may possibly be a factor in the situation. It was stated to be so in Livonia (Von Loewis, *Zool. Garten*, 1877, 17-20), and in certain parts of North America similar changes have resulted in restriction of the area occupied by the "Snowshoe Rabbit" (*L. americanus*), and a consequent extension of the ranges of the Prairie Hare (*L. campestris*) and of the cottontails (*Sylvilagus*).

In Newfoundland, on the other hand, the Nova Scotian Varying Hare, *L. americanus struthopus* of Bangs, which was

introduced in 1864, although a woodland species, is reputed to have caused a marked decrease in the numbers of the Newfoundland Hare, *L. arcticus bangsi* of Rhoades, and the latter is stated to be now restricted to the highest and barest uplands (Nelson, *North Amer. Fauna*, No. 29, 1909, 65 and 92).

Winter Whitening:—Although the varying hares have gained their name from the fact that in winter they don a white coat, this peculiarity is not restricted to them, being found also in all northern forms of hare. *L. europæus* may also whiten in winter, although not so readily as the varying hares.

Various eccentric views prevailed amongst the older writers, from Pliny, who attributed the whitening to the action of eaten snow, to Pennant (*Arctic Zoology*, 1792, i., 110), who maintained that "these animals, at approach of winter, receive a new coat, which consists of a multitude of long white hairs, twice as long as the summer fur, which still remains beneath." Richardson (*Fauna Boreali-Americana*, 1829, i., 218) thought that "the change to the winter dress takes place by a lengthening and blanching of the summer fur" with a complete moult in the following spring. Audubon and Bachman, writing of a caged American stoat (*Quadrupeds of North America*, 1854, 62, etc.), arrived at the conclusion that the colour is lost or regained after the spring and autumn moults, while Coues (*Fur-Bearing Animals*, 1877, 123) assured himself that the alteration might or might not be coincident with shedding of the fur. Merriam (*Vertebrates of the Adirondack Region*) believed that both in autumn and spring there is an actual change of colour in the hairs, governed by the presence or absence of snow, not affected by temperature, and occurring independently of the moults. Von Loewis, writing (*op. cit. supra*, p. 300) of Livonian hares, affirmed the vernal but could not admit an autumnal moult; Schwalbe, who worked on stoats, attributed the changes to two moults.

This was also the view of an anonymous writer in the *Edin. Philosoph. Journ.* (ii., January to April 1820, 191). Of other British writers, excluding Pennant's somewhat fantastic opinion as quoted above, both Jenyns and Fleming (the latter of whom examined the changes in a stoat, see *Edin. Encyc.*, art. "Hybernation," 1817, xi., 387; *Philosophy of Zoology*, 1822, ii., 23)

supported a change in pigmentation without actual renovation of the fur either in spring or autumn. All modern observers are in agreement that the vernal replacement of white by brown is due to a moult and casting of the white hairs; the autumnal blanching, on the other hand, is still variously attributed to moult or to actual abstraction of pigment from the hairs. The latter view was taken by Welch (*Proc. Zool. Soc.*, London, 1869, 228-236), and in 1874 by Alston when editing Bell's second edition. It was utilised by Poulton as the chief basis of his theory on variable protective resemblances in vertebrates (see *The Colours of Animals*, 1890, chap. vii.), and was generally accepted until, in 1894, Allen (*Bull. Amer. Mus. Nat. Hist.*, vi., art. iv., May 1894, 107-128) asserted that in *Lepus americanus* both autumnal and vernal changes are accomplished by moult, a view supported by Collett in regard to *L. timidus* in Norway. Allen was not aware if the underfur of American hares is shed in autumn, but Nelson states (*op. cit. supra*, 18) that in these the underfur does not whiten as it does in European forms.

The first British writer to arrive at the truth seems to have been MacGillivray, whose discovery that the pelage is almost always undergoing alteration and renewal cannot be controverted; while his apparently contradictory belief that nevertheless "sometimes the brown hairs themselves, on the application of intense cold, become whitened" (see William MacGillivray's *Life of William MacGillivray*, 1910, 130) has been corroborated by Metchnikoff. The latter, who has since been supported by Tomaszewski and Erdmann (*Münchener medic. Wochenschr.*, 1906, 359), showed (*Ann. de l'Institut Pasteur*, 1901, 865, pls. 13, 14, and *Proc. Roy. Soc.*, London, lxi., 1902, 156) that, in senescence of old men and dogs, large cells, which he named chromophages ("colour-eaters"), issuing from the central medullary parts of the hairs, enter the cortical layers, where they engulf and remove the granules of pigment. The process may thus be classed under the general laws of atrophy of solid portions of an organism. In a later paper (*Compt. rend. Acad. Sci.*, cxlii., No. 19, 7th May 1906, 1024-1028) Metchnikoff reported that the same facts apply to the hairs of *Lepus timidus* and the

feathers of *Lagopus albus*, both of which are thus shown to be living structures. He held that the phenomenon is one of a general kind, which would be found present in other whitening animals such as ermines and mountain squirrels. Metchnikoff thus proved that the view frequently expressed that whiteness might be due to bubbles of air entangled in the structure of the hairs is erroneous. Trouessart (*Compt. rend. des séances Soc. Biol.*, lx., 10th February 1906, 271) corroborated Metchnikoff as a result of the examination of ermines and squirrels. He found that after loss of pigment the central medulla of a hair becomes desiccated, retracts, and dies.

The cycle of coat and colour changes undergone in a cold country of comparatively regular climate is different from that which prevails in the milder but uncertain weather of Britain, and this fact accounts for much discrepancy between reports from various localities. As stated above, the existence of the spring moult is undoubted (Barrett-Hamilton, *Proc. Zool. Soc.*, London, 16th May 1899, 598), but careful search for an autumn moult is often unavailing. A Scottish Hare kept alive at Cambridge during the autumn of 1899 by Barcroft, had turned almost completely white by January 1900 (*Proc. Roy. Irish Acad.*, xxiv., B, 11th May 1903, 303-314). But, although it was constantly under observation in a specially constructed cage, no trace of depilation was detected.

I have since found the autumnal moult occurring irregularly in wild specimens of the Irish Hare, but at the same time a number of Scottish Hares were examined in different localities on my behalf, and there was no shedding of hair, so that observation supports MacGillivray's view, that in Britain both moult and withdrawal of pigment may exist side by side. The change of pelage is as irregular as the climate in which the animals live, and is so susceptible to the influence of the weather that, as shown by MacGillivray, although the great annual casting takes place in the spring, there may be a renewal at any season or in any month.

The autumnal depigmentation varies with the locality and the climate. In a cold country of regular seasons it comes on early and is rapidly completed. In a temperate country of irregular weather it begins gradually, lasts a comparatively

long time, but may apparently be accelerated by the advent of severe cold, if it occurs before its completion.

In Eastern Siberia a male of *L. ghiciganus* had nearly completed the change by the 1st October (Allen, *op. cit.*, 1903, 156). In Athabasca *Lepus americanus* begins to assume the white coat about 20th September, and the process is finished by 20th October, the young being earlier than the adults (Preble, *North Amer. Fauna*, No. 27, 1908, 203). In North Europe there is much variability according to locality, but in cold districts the winter coat may have been donned in its entirety by the first week of October (Collett). In Scotland the whitening starts in September or October, but is not completed until the middle of November or the beginning of December. In Ireland the blanching, when it occurs, advances in much the same manner as in Scotland, but is extremely variable and usually incomplete. It commences about November, progresses at a gentle rate, and may rapidly terminate in cases of considerable whitening within the first few days of December (*Proc. Royal Irish Acad. cit.*, 306).

The order of change of the various parts of the body from brown to white is not invariable, but, on the whole, both in Europe and America, follows a fairly regular sequence. The feet and legs, the grey parts of the ears and parts of the head, are the first affected. Then follows the rump, and the white area of the under-side creeps upwards, driving the line of demarcation before it, until the brown of the back is extinguished, or remains as an island or islands. Portions of the head may also remain brown. Although the above procedure is more usual, some individuals, especially in Ireland, seem to become gradually white all over, and pale spots often appear in the middle of brown areas. In the spring the order of change is reversed, the brown colour starting on the head and upper back and working downwards. The black ear-tips never alter, not even in the otherwise always white Greenland Hare, probably because the hairs composing them are subject to a single annual moult only; apart from that the process of incipient whitening in the Brown Hare seems to indicate that brown shades whiten more readily than black.

According to Collett, the wool becomes detached later than

the long hairs in autumn, but in spring it precedes the hairs; I am not sure that this is correct.

There is some, but not conclusive, evidence that the animals which, where the process is not invariable, turn whitest and remain so longest are females, or old individuals of both sexes. It was probably this feature that led William Thompson to conclude of the Irish Hare that it whitens mainly in parks, where, owing to protection, it can grow old, and that the change only becomes conspicuous after the fifth year. Late-born young are slower to moult than adults.

The spring change is no less variable in date than that of autumn. Even in a country enjoying such a temperate climate as the south of Ireland it may take place at such an unexpectedly late season that it results in the remarkable spectacle of a hare running about in all its conspicuously white arctic livery under the bright rays of a May sun (see Barrett-Hamilton, *Proc. Zool. Soc. cit.*). It must be remembered that this remark refers to one of the mildest parts of the British Isles; but resumption of the pigmented pelage is long delayed also in Scotland and in Wales, where the introduced white hares may be seen until the end of April, or even in May. The same facts apply also in other countries. An adult female of *L. ghiciganus* of Eastern Siberia was still partly in the winter dress on 28th May (Allen, *op. cit.*, 1903, 156), while at Fort Chipewyan, Athabasca, Preble (*op. cit.*, 199) found *Lepus americanus* retaining a few scattered hairs of the winter pelage late in the same month, and in Finmarken the summer dress is not assumed until July (Collett). On the other hand, Coward (*Zoologist*, 1901, 74) saw the fur blowing off the imported Blue Hares of the Cheshire hills in March; and in January 1910 I examined two male Irish Hares in full moult. To illustrate the uncertainty of the moult, in the same year and on the same ground two heavily whitened Irish does retained their winter coat; one of them, a fine animal weighing 9 lbs., until killed on the 9th April; the second was distinguishable by her whiteness well into the month of May.

According to the above account, winter whitening is essentially the same phenomenon in all species exhibiting it. It varies only in details dependent largely on local conditions.

In the extreme north adult hares are white all the year round without variation, the young alone showing traces of a pigmented coat (*e.g.*, in the Greenland Hare, Feilden in Nares's *Polar Voyage*, 1878, ii., 204). In countries where the assumption of a white coat is invariable but seasonable, the length of time for which it is worn is more or less rigidly marked out by long custom apart from the influence of the weather, which cannot greatly retard or hasten the normal sequence of events. Animals captured in such conditions and placed in the shelter of confinement still whiten if they have been accustomed to do so while at liberty, as they do also if removed to a more southern locality, or even, it is said, if kept in heated apartments (Bingley); the latter point would, however, seem to require confirmation.

In temperate countries, as Britain, where the process is either not invariable or frequently incomplete, it is very subject to climatic as well as to other influences, such as sex, age, health; and the result is much variability. In Wexford an individual may be found assuming the white coat in December, and another moulting back to the summer pelage in January. The effect of severe cold in Britain may possibly be observable in the increased whitening which is said to ensue in the subsequent winter, even if it be a mild one.

It is not known how long transported individuals and their descendants will continue to change in a milder climate; Irish and Scottish specimens imported to Mull are said to retain their respective whitening characteristics, but exact details are lacking. The Norwegian hares mentioned above on page 294 as having been introduced into the Faroe Islands are said, with very few blue-grey exceptions, to have whitened regularly at first. Gradually, however, the grey individuals became more numerous and the white scarcer, until, in 1860, out of one hundred shot only five or six were white, the others being bluish grey. Thus, in less than forty years the winter coat had changed its character.

THE MOUNTAIN OR BLUE HARE.

LEPUS TIMIDUS, Linnæus.*LEPUS TIMIDUS SCOTICUS* (Hilzheimer).

1758. *LEPUS TIMIDUS* (species), Carolus Linnæus, *Systema Naturæ*, x., 57 (part); xii., 77, 1766; described from Upsala, Sweden; Lydekker; Thomas, *Zoologist*, 1898, 101; Johnston; Millais.
1778. *LEPUS VARIABILIS* (species), P. S. Pallas, *Novæ Species Quadrupedum Glirium Ordine*, 2 (part); renaming *L. timidus* of Linnæus; Berkenhout; Turton; anon., *British Cyclopaedia*, 704, 1836; Bingley; Fleming; MacGillivray; Clermont.
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1770. ALPINE HARE, Thomas Pennant, *British Zoology*, iv., 40, pl. 47 (habits and occurrence in Scotland described); *Synopsis Quadrupedum*, 1771, 250; *Tour in Scotland* in 1769, 1772, ed. Pinkerton, 96; Lightfoot's *Flora Scotica*, 1777, 11, No. 21.
1772. WHITE HARE, Thomas Pennant, *Tour in Scotland* in 1769, ed. Pinkerton, 96.
1781. VARYING HARE, Thomas Pennant, *History of Quadrupeds*, 370; a footnote in Index, xvii., explains the changed name from *Alpine Hare* of the *Synopsis Quadrupedum*.
1808. *LEPUS TIMIDUS*, . . . β . *L. alpinus*, corpore cinereo-albo, auriculis apice nigris. The Alpine Hare. Scot. The White Hare. Intolerandi rigoris alumnus. Plin. John Walker, *Essays on Natural History*, xiii., 491 and 493 (probably written between 1764 and 1774); described from Scotland—"Locus-Habitat versus cacumina montium Scotiae altissimorum, locis scopulosis. Monte Cruachan dicto in Argathelia, Ben Nevish in Abria, et praesertim montibus in Rossia occidentali, ubi frequentissimus est"; preoccupied by *Lepus timidus alpinus*, Erxleben, *Systema Regni Animalis*, i., 328, 1777, a synonym of *L. timidus*, Linnæus, and by *L. alpinus*, Pallas, *Novæ Species Quadrupedum Glirium*, 1773, an OCHOTONA.
1816. *LEPUS ALBUS*, W. E. Leach, *Systematic Catalogue of the Specimens of the Indigenous Mammalia and Birds that are preserved in the British Museum*, 7; adopting Brisson's *Lepus albus*, named, but without description, from Scotland, hence a *nomen nudum*, but in any case preoccupied (see below).
1819. *LEPUS ALBUS*, W. E. Leach in Sir John Ross's *Voyage of Discovery*, ed. i., app. ii., pp. xlv-xlvi; ed. ii., vol. ii., app. iv., 15 and 170, the last reprinted in *Ann. of Phil.*, September 1819, xiv., 201, from Brisson; described from Scotland; preoccupied by *Lepus timidus albus*, J. M. Bechstein, *Gemeinnützige Naturgeschichte Deutschlands*, etc., 1801, i., ed. ii., 1096, described from Thuringia, Germany; Jenyns.
1857. *LEPUS VARIABILIS*, b. Form der Mittelregion und der Alpen, J. H. Blasius, *Säugethiere Deutschlands*, 424 (part).
1900. *LEPUS TIMIDUS TYPICUS*, G. E. H. Barrett-Hamilton, *Proc. Zool. Soc.* (London), 6th February 1900, 88 (part); Millais.
1906. *LEPUS MEDIUS SCOTICUS*, Max Hilzheimer, *Zool. Anzeiger*, xxx., 511, 14th August 1906; Trouessart (1910); described from Scotland.
1909. *LEPUS VARIABILIS SCOTICUS*, M. A. C. Hinton, *Sci. Proc. R. Dublin Soc.*, xii. (N.S.), No. 23, 8th September 1909, 231, etc.

Le Lièvre blanc of the French ; *Der Schneehase* of the Germans.

The synonymy (apart from the first two items, which refer to the species *timidus*) is that of the Scottish Hare, without reference to its allies on the Continent; apart from the question of the use of the specific names *timidus* and *variabilis*, which has been already explained above on p. 251, it presents no difficulties. The animal is a fair subspecies, being intermediate in size and colour between those of Skandinavia and the Alps.

It is unfortunate that Leach's name is barred for technical reasons. In 1819 he remarked of a hare obtained during Ross's voyage that it was very distinct from the common White Hare of Scotland (*Lepus albus* of Brisson), and equally so from the *Lepus variabilis* of Pallas. But it is evident that he did not understand the true relationships of these animals; they could not, indeed, be demonstrated until a series of adults from the various European localities was brought together, a work first accomplished by Miller. Hilzheimer, albeit his arrow was shot at a venture, has priority, and the Scottish Hare must be known by the name which he gave it.

Local names:—See under the preceding species. The animal rejoices in a number of names well known in books and too obvious to need explanation, such as Alpine or Mountain, Changing or Varying, Blue, Snow, or White Hare.

History:—"White hares" must always have been well known in the Highlands, and are mentioned as occurring in the Orkneys in the twelfth and again in the sixteenth centuries (see p. 310). Zoologists, however, appear to have been ignorant of their occurrence. They are not definitely named in Gordon's *History of the Earldom of Sutherland to 1630*, published in 1813; and have no place in Merrets' list (1666), nor in Ray's *Synopsis*, although the latter naturalist was well acquainted with the existing descriptions of Varro's Varying Hare, which he records as being frequent in the mountains near Padua, and having ears with black tips. Like Topsel (1658), he evidently obtained his information from Gesner, but the latter's assertion (p. 683) that he had heard of White Hares also in England, probably refers to varieties of *L. europæus*, two of which were mentioned by Morton in his *Natural History of Northamptonshire*, 1712, 445. A statement that there is an annual rent, consisting of two white hares, at Sheffield, enjoined by ancient deed, is due to an error in reading 39 Edw. iii., where the correct words are "duos leporarios albos" = "two white greyhounds" (see Pegge's *Anonymiana*, 1818, 159.)

It is probable that the first printed allusion to the Scottish Hare by a British zoologist was that of Gilbert White, who wrote of it to Pennant (letter xxvi., 8th December 1769):—"It pleases me to find

that white hares are so frequent on the Scottish mountains, and especially as you inform me that it is a distinct species; for the quadrupeds of Britain are so few, that every new species is a great acquisition."

White's remarks are explained by Pennant's own statement in his *Tour in Scotland* (1772, 96), that on 31st August 1769 he met with "white hares" on the summits of the hills by Loch Ness, Inverness, and (p. 102) that on 4th September following he noted the occurrence of "Alpine Hares" at Glencoe, Argyllshire. The species made its first appearance in his works in 1770 (see above, under Synonymy). He probably also observed these animals on the island of Islay, since in writing of its fauna in 1774 (p. 230) he mentions "hares: the last small, dark-coloured, and bad runners." It is pretty certain that he sent one to Daines Barrington, for the latter, who, like Pennant, corresponded with White, wrote (*Phil. Trans.*, lxii., 1772, 11, footnote *b*) of the "Alpine Hare" that "This species of Hare is found in the Highlands of Scotland, whence I received a specimen, which I had the honour of presenting to the Museum of the Royal Society." The Museum or "Repository" of the Royal Society was handed over to the British Museum in 1779, but its contents were not specially labelled, so that Barrington's specimen cannot be traced.

Another writer, Walker, whose *Essays* (see Synonymy) although not published until 1808, were probably written between 1764 and 1774, must have known of the existence of White Hares at an early date, but there is no means of ascertaining exactly when, and he may have obtained his knowledge from Pennant.

Distribution:—The Scottish Hare is now indigenous only to the **Highlands of Scotland**. Elsewhere in Scotland, although not indigenous, it is widely distributed owing to numerous introductions, the first of which took place in the 'thirties and 'forties (W. Evans), in the counties of Peebles, Ayr, and Lanark. From these districts the hares dispersed widely, and they now frequent all hills of 1500 feet and upwards, and very many of lower elevation. The subspecies may, therefore, be described as thoroughly established in all suitable localities throughout the south and south-west of Scotland (for further particulars, see Alston; Service, *Zoologist*, 1893, 265, and 1895, 375; Boyd Watt, *Trans. Nat. Hist. Soc.* (Glasgow), vii., N.S., February 1905, 13; W. Evans; and Harvie-Brown's Faunas); but in all cases south of the Clyde and Forth, as the result of introduction by man. The latest extension of range, as reported by W. Evans includes the Berwickshire portion of the Lammermuir Hills, where it is fast becoming plentiful.

Where not shot down, the Mountain Hare is extremely numerous in many parts of the Highlands; in so much so that although its pursuit is not valued from a sporting point of view, it is customary to organise

"drives" for its destruction. In one such drive at Logiealmond, Perthshire, in November 1899, six guns killed 1289 in one day (Lascelles, *The Hare*, cit. supra, 99; see also Harvie-Brown and Buckley's *Moray Basin*), so that it is not surprising to find that its numbers have been considerably reduced in many places. Under the artificial conditions imposed by man its present distribution is very unstable; it is undergoing extermination in one district, introduction in another; and, it seems, therefore, unnecessary to give a detailed list of localities.

On the whole it appears to be naturally (*i.e.*, apart from the influence of man) an increasing animal, and Scottish naturalists have more than once alluded to a supposed newly acquired habit of descending to the cultivated lands, or to those near the sea. Harvie-Brown and Macpherson (*North-West Highlands and Skye*, 44) connect this propensity with heavy falls of snow on the higher land, and Millais (*Field*, 18th February 1911, 330) with hard winters. The latter states that in 1881, 1885, and 1894, large numbers of Blue Hares descended from the mountains above the Tay in Perthshire, and some remained "in the roughs and woods at river level for two and even three seasons afterwards"; the result was a good deal of hybridism with the Brown Hares. The same habit prevails at all seasons in the Outer Hebrides where heavy snow-falls are rare (Harvie-Brown and Macpherson, *op. cit.*).

Wherever Blue Hares are now found in the **Scottish Islands** their presence is due to introduction; but, although there is little evidence, it is not improbable that they were originally indigenous in the Orkneys, as well as in the Outer and Inner Hebrides. There are published records of their occurrence in Arran (Alston), Mull (imported by Colonel Gardyne of Glenforsa), where Irish Hares have also been introduced (Harvie-Brown and Buckley), Islay (Pennant; see under *History*), Skye (Harvie-Brown and Macpherson), and Raasay (Macpherson). In the Outer Hebrides they are absent from Barra, North Uist, and South Uist, are nearly extinct in South Harris, and fairly numerous, although of poor appearance, in Lewis and North Harris (Millais); in North Harris they have long been treated as vermin (Harvie-Brown and Buckley).

They are absent from the Shetlands, but, as stated above, there is evidence that they were formerly indigenous to the **Orkneys**. Barry (316) quotes a passage from the Sagas wherein Earl Harold is said to have gone to Gairsey to hunt hares, in the twelfth century. In a description of the islands written in 1529 by Jo Ben (= John Bellenden, Archdeacon of Moray), occur the words, referring to Hoy:—"albi lepores hic sunt et capiuntur canibus"; and in 1684 Sibbald wrote: "In *Orcadibus* reperitur, crinibus candorem nivalem referentibus." The last note of the indigenous stock appears to have been that in

Mackaile's MS., dating from near the end of the seventeenth century, as quoted by Baikie and Heddle:—"There are no foxes nor hares, only I was informed that about eighty years ago there were several, either white or black hares, on the two great mountains of Choye."

They have been reintroduced to Gairsey (Harvie-Brown and Buckley) and Hoy, but Millais stated that he could obtain no news of them on a recent visit to the islands.

Scottish Hares have been introduced into many **English counties**, where they seem to thrive as well on moors and hillsides as in Scotland. It would be impossible to give a complete list of records, especially as the animals sometimes spread quickly over the country and colonise a wide area. In Cheshire, for instance (Coward and Oldham), they have firmly established themselves on the uplands as the result of an introduction from Perthshire into Yorkshire. In the latter county they have greatly increased, so that in May 1893 a keeper counted fifty within range of his field-glasses (Coward, *Zoologist*, 1901, 73-75); they have also appeared in Derbyshire, but in the north of Stafford the descendants of an introduction effected about 1906 have been exterminated (Masefield, *MS.*). Abel Chapman has kindly sent me a note of a recent introduction in Northumberland, near the Roxburgh border. In **Wales**, too, there have been several introductions, so that White Hares may be seen on many of the mountains, especially in North Carnarvon (Forrest). A notable instance is that of the second Lord Penrhyn on Llandugai Mountain; the late G. W. D. Assheton Smith brought a few hares from these mountains to his park at Vaynol, near Bangor (see also under Irish Hare), but they did not thrive well, for which information I am indebted, through the kindness of Forrest, to L. V. Lort. These hares came from Abercairney, near Crieff, Perth.

There has been at least one **Irish introduction**, viz., on the coursing grounds at Black Brae, Co. Londonderry (see Barrett-Hamilton, *Irish Naturalist*, March 1898, 76).

The numberless transportations by sportsmen of Brown, Scottish, and Irish hares are probably now past accurate tracing in detail. Where reasonable care is taken to transfer individuals in good health, no difficulty whatever is found in naturalising either of the three in another's territory. Frequently an introduction is put down as a failure either because the hares are shot down by strangers before they have become established, or because they are so badly injured in transit that they perish after having been released. They are strong, violent animals, and easily knock themselves about in a box, and should be dispatched in a package so arranged that each has a separate compartment.

Distribution in time :—No fossil remains of hares have been described

from Scotland, and all those found in England appear to belong to Hinton's Hare, *L. anglicus*, which has been identified by its describer from Ightham Fissure, Kent; Somerset, and from Longcliffe Cave, Derbyshire.

Status:—The Blue Hare of Scotland differs in some important respects from the Irish Hare, and from its forerunner the extinct Hinton's Hare, and is very closely allied to the subspecies of *L. timidus* inhabiting continental Europe. This fact suggests a comparatively recent connection between Great Britain and the Continent, and leaves it an open question whether the west Skandinavian stock of *L. timidus* migrated there from Scotland or *vice versa*. If there are really two subspecies in Skandinavia, one of them may have reached that country from the East. The question will be found discussed again under genus *MICROTUS*.

Description:—Both in external and cranial characters the Blue Hare is typical of the group *Lepus*. It differs from the Brown Hare in its smaller size, larger head, rounder and fuller eyes, and shorter ears, which when bent forward, hardly reach the tip of the nose. The legs are relatively longer; the tail is shorter and wholly white; the fur is soft and woolly; the whiskers are not nearly so long and coarse, and the hair on the soles is softer. The animal is in summer dusky rather than tawny or "ochraceous," and in winter more or less white; when the white and dusky shades are intermingled it exhibits the tint popularly known as "blue."

In the **fur** the annulated hairs, although long and piercing the underfur, are not nearly so strong and conspicuous as in the Brown Hare, and the whole pelage is consequently softer. There are fewer of the extra long dusky hairs.

The **underfur**, which, however, in a healthy animal in good coat does not show through the hairs except on the nape, flanks, and rump, is on the upper side in summer bicoloured, having a dusky base tipped with "seal brown" or even "clove brown"; it passes gradually to white on the under side, as also frequently on the rump.

The ordinary hairs exhibit annulations corresponding to those of *L. europæus*, *i.e.*, they are dusky, with a whitish base and a subterminal band of "seal brown" or "clove brown." Frequently, however, the dark tips are absent, having probably been worn away, and there is much variation in tint, probably in accordance with the age of the hairs. In a healthy adult the general colour of the back is derived from the blended effect of the annulations, so that the upper side affects some shade of "blue," or deep brown, bordering on dusky; sometimes it is grizzled or almost frosted. On the rump the extra long hairs with black tips are more numerous, and contrast with the light underfur, but they are scarcer on the face, which accordingly has a clearer appearance.

histories of very many others, which were formerly little known, have been fully elucidated, while, speaking generally, an immense increase in our knowledge on such important subjects as Migration, Distribution, Habits, Nidification, Plumages, has accrued: And lastly, a new and important branch of study has been instituted—namely, the recognition of the various Racial Forms or Sub-species exhibited by certain birds in the British Islands, on the Continent, and elsewhere.

A great advance has also been made towards a more satisfactory system of classification of the Aves—always a difficult subject—and this necessitates departures from the older views.

To bring this Standard Work thoroughly abreast of the most recent knowledge in all these departments is the object of the present work.

It should be remarked that while it is not intended to go fully into Synonymy, yet, where changes of nomenclature have been necessary in order to conform with the Law of Priority—the only method by which complete uniformity in nomenclature can ultimately be attained—the names used in the Fourth Edition of Yarrell's "British Birds" and in Saunders' "Manual," and the Trinomial Names of the British Racial Forms, and of those occurring in Britain as visitors from the Continent, will be quoted, as will also the Original Name under which the species was described.

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"In conclusion, we may say that we have nothing but praise for Mr Clarke's book, and congratulate him on bringing it to such a successful conclusion. It is eminently the product of a worker; to the beginner in the study of migration it will point out the right lines of investigation; to the student it gives much interesting matter for consideration, and it will be read with great pleasure by every ornithologist."

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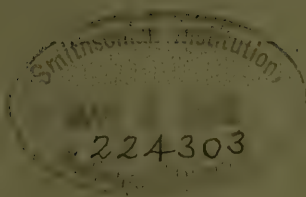
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EDITED BY

WILLIAM EAGLE CLARKE, F.R.S.E., F.L.S.

Keeper of the Natural History Department, The Royal Scottish Museum; Member of the British Association Committee on the Migration of Birds as Observed on the British and Irish Coasts; Corresponding Fellow of the American Ornithologists' Union;
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In the year 1871 a Fourth Edition was begun, under the masterly editorship of Professor Newton—the greatest British ornithologist of all time. Unfortunately Professor Newton's official engagements at the University of Cambridge only allowed him to complete the first two volumes; and in 1882 Mr Howard Saunders was selected to edit the remaining volumes, a task which he successfully accomplished to the entire satisfaction of ornithologists in 1885.

The many excellences of this last edition advanced the work more than ever in the public and in scientific favour. To its stimulating influence is to be mainly attributed the marvellous and unprecedented activity which has resulted in those extraordinary advances made in all branches of British ornithology during recent years—advances which have rendered it essential that a new work based upon this classical and comprehensive foundation should be issued.

During the period alluded to, a considerable number of new and interesting species have been added to our avifauna. The

CONTENTS OF PART XIII.

RODENTIA (Rodents)—

Leporidae (Hares and Rabbits)—

Genus *Lepus*—

Group *Lepus*—

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<i>Muscardinidae</i> —	
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Genus <i>Muscardinus</i>	351
The Dormouse or Sleeper	353

The English local names have been revised in part by Mr W. W. Skeat, M.A. (assisted by the late Professor W. W. Skeat), and in part by Mr C. M. Drennan, M.A. Lond., late Scholar Emm. Coll. Camb.; the Celtic and Gaelic names by Dr E. S. Quiggin, M.A., Ph.D., Fellow and Lecturer in Modern Languages and Celtic of Gonville and Caius College, Cambridge; while a list of Scottish Gaelic names have been supplied by Mr C. H. Alston. Valuable assistance has been rendered by Mr M. A. C. Hinton regarding extinct Mammals. Much information has been taken from Mr G. S. Miller's recently published "Catalogue of the Mammals of Western Europe," for the use of the MS. and proofs of which before publication I am greatly indebted to the Trustees of the British Museum.

ILLUSTRATIONS

FULL-PAGE (*Black and White*).

Tracks of Hedgehog and Irish Hare.

The Dormouse—Left Ear, Hand, and Foot; Side View of Tail.

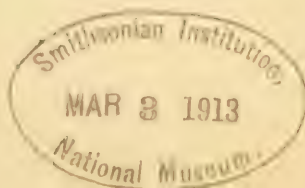
FIGURES IN TEXT.

Right Ramus of Mandible of—(1) *Lepus hibernicus*; (2) *L. (Eulagos) europæus*; (3) *L. timidus scoticus*; (4) *Oryctolagus cuniculus*.

Diagram of Spoor of Irish Hare.

Skull of *Muscardinus avellanarius*.

Check-Teeth of *Muscardinus avellanarius*.



The tip of each ear is black for an extreme depth of about 30 mm. externally; internally the black colour appears only as a thick rim, having a width of about 5 mm. Beneath the black tip the exterior half of the posterior surface and the whole of the interior is grey, with the border whitish; the rest of the ear is clothed with brown hairs tipped with black, the general colour being like that of the back. The outer surfaces of the limbs differ only from the back in being lighter in colour, and having fewer black-tipped hairs. The soles are dusky. The belly and tail are white; the chin and upper throat, dirty white; the lower throat and upper breast resemble the back, but are of a less clear tint. The line of demarcation is very uncertain and variable, depending on the season. The soles are soft to the touch.

Leverets have a woolly juvenal coat, as described on p. 162; the subterminal bands of the hairs are lighter, so as to give a frosted appearance. The upper side of the tail often carries a few dark hairs.

In the full **winter coat**,¹ which, owing to a great development of the wool, is closer, fuller, and longer than that of summer, both hair and wool, except on the black ear-tips, are white; but the dorsal region always retains a remnant of pigment, and parts of the backs of the ears and of the face are not infrequently coloured as in summer. The feet are very thickly furred. The white coat begins to appear in September, and is perfected by the middle of November or the beginning of December, the commencement of the process being slow, the completion rapid. Any moult which takes place is so gradual and difficult to observe that it may easily be overlooked, and, as stated above on p. 303, its existence does not preclude direct abstraction of pigment. Sometimes the animal becomes paler all over, but usually the feet, with portions of the ears and of the head, are the first to change; the portions of the head which change first being the muzzle, the bases of the ears, and two lines running thence, one on each side, to the muzzle and including the eyes. The white colour then gradually advances up the legs and flanks, first crossing the upper surface at the neck, and isolating the back and part of the top of the head. Meantime spots of grey or white may precede the general advance. According to Collett, Norwegian hares cast the underfur after the hairs in autumn, but before them in spring, when white hairs may be found overlying pigmented underfur, and this appears at first sight to be true of the Scottish Hare, of which specimens in moult have been sent to me by Rodger; but in these there was present, underlying the long white winter coat, both pigmented hair and wool, most

¹ Karl Pearson has figured a skin of this hare for each month in the year, but his descriptions have not yet been published (*Albinism*, 1911, fig. YYa). Abnormal skins are also figured (ZZ).

distinctly coming up together, so that I suspect Collett to be in error. The spring moult is much more easily observed, and there has never been doubt about it. Although irregular, it is much less so than that of autumn; some individuals may regain their summer coat in March, while others received on 24th April 1899, through Ogilvie-Grant, from the third Lord Cawdor, Cawdor Estate, Nairn, were then in full moult; and the same date is applicable to Perthshire (Rodger). In the Outer Hebrides also the white coat may be carried until the end of April (Harvie-Brown and Buckley, *Outer Hebrides*, 39), and in the south of Scotland partially white hares may be seen until the third week of that month (Evans for the Ochils), and even later (4th May, Campsie Fells, Clyde area, Boyd Watt; 9th May, Pentlands, one partially white, Evans, *MS.*). In Wales A. H. Macpherson (*Zoologist*, 1890, 216) observed two apparently quite white individuals at a height of 2500 feet on Snowdon, on 6th April 1900. The variation in details is easily accounted for as resulting from an irregular and almost continuous change of coat influenced and subject to local conditions of climate, shelter, food, and the idiosyncrasy of each animal.

The **skull** is typical of true *Lepus* (see above, p. 293). It differs from that of *L. hibernicus* in its smaller size (see details under *L. hibernicus*, where every item of the latter, except the length of the mandibular tooth-row, is greater); and in the more elevated superciliary processes. The **teeth**, both incisors and molars, upper and lower, are narrower, lighter, and shorter than in *L. hibernicus*; hence the mandible is not so deep, and the growing ends of the lower incisors show just in front of the tooth-rows. In *europæus* the mandible is longer, and, in agreement with the shorter cheek-teeth, shallower; the growing ends of the short lower incisors fail to reach the tooth-rows by at least the lateral breadth of a cheek-tooth (see Fig. 48, p. 315).

Individual colour variation is very frequent and conspicuous, being dependent, besides age, on the amount of whitening undergone by individuals. Apart from the influence of moults and whitening, there appears to be frequently present a certain amount of dichromatism, which exhibits itself in two varieties, one the ordinary deep brown form, the other yellowish.

Abnormal colour variations are rare. A black female in the possession of the Duke of Portland was taken at Braemore, Langwell, Caithness, on 3rd February 1902 (Dunbar, *Ann. Scott. Nat. Hist.*, 1902, 250; Anstey, *Field*, 22nd February 1902, 281). Another black specimen from Achnaclay, Caithness—not Galashiels, Roxburgh, *vide* Eagle Clarke—(Small, *Ann. Scott. Nat. Hist.*, 1903, 116), is now in the Royal Scottish Museum. Buff varieties have been recorded, as by Millais, but the species has not always been made clear; a yellow pink-eyed individual was observed to turn white in winter (Crawshay, *Field*, 31st

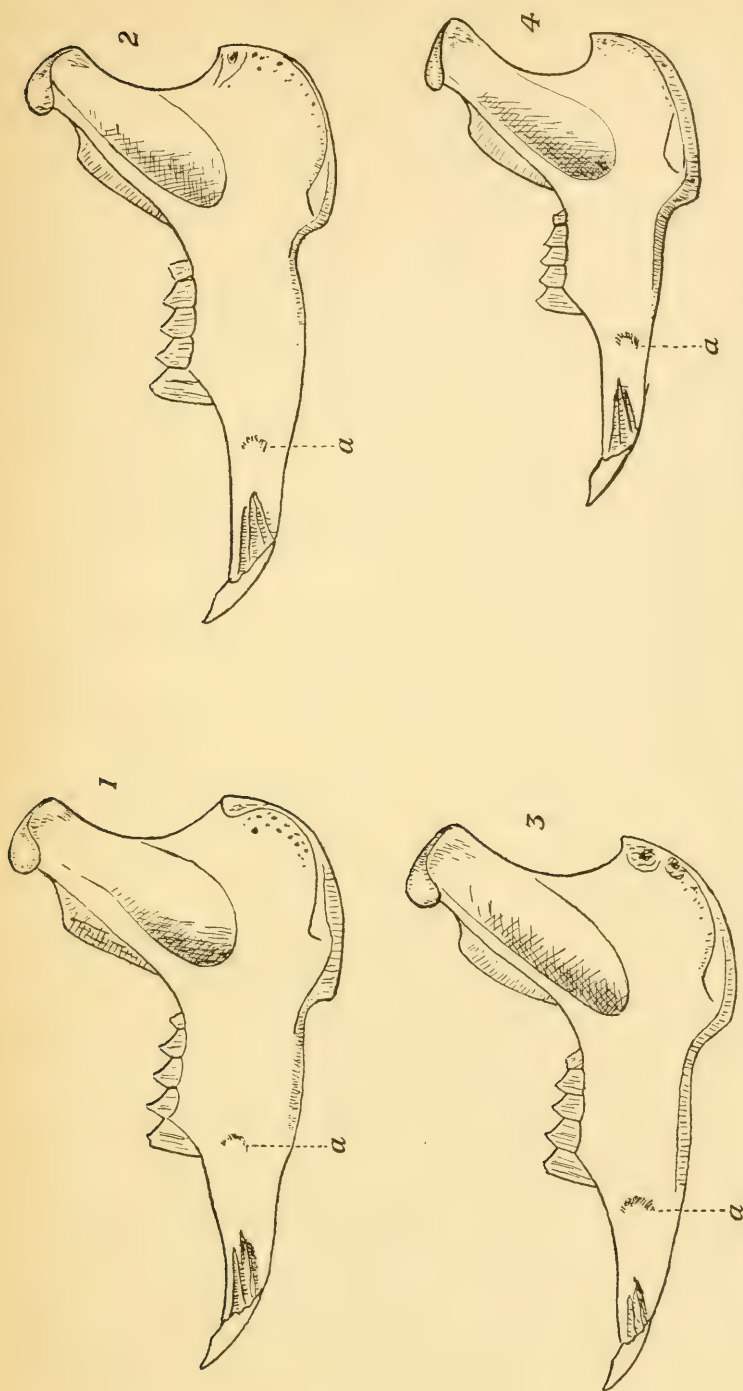


FIG. 48.—RIGHT RAMUS OF MANDIBLE (inner view) OF (1) *Lepus hibernicus*, (2) *L. (Eulagotis) europæus*, (3) *L. timidus scoticus*, (4) *Oryctolagus cuniculus*, (Natural size.)

(a) Little lump marking position of the growing end of the incisor.

For descriptions, see pp. 175, 249, 294, 314, and 333.

[Drawn by M. A. C. Hindon.]

October 1891, 655). A cream-coloured example was taken at Torish, Ben Duan, Sutherland (Buckley, *Ann. Scott. Nat. Hist.*, 1892, 158).

Hybridism :—See above under genus *LEPUS*, p. 236.

Geographical variation :—There are several closely allied subspecies. The true *timidus* of southern Skandinavia, which is mainly a south coast form, ranging west to Jæderen, is the largest, having each hind foot¹ measuring as much as 160, and the occipito-nasal length of the skull as much as 103 mm.; this is the "Plain" or "Jæderen Hare" of the Norwegians, who recognise also, in northern Skandinavia and the mountains of the south, a Common or "Fjeld Hare," to which, if it be distinct, Nilsson's name *collinus* seems to be applicable. The former is characterised, although not universally, by a grey winter coat correlated with a tendency of the black ear-tip to spread downwards, forming a noticeable patch on the outer surface of the ear; in the latter the winter coat is white and the ear-tip restricted. *L. timidus varronis* (Miller) of the Alps is a smaller animal, with the hind feet each about 150 mm. long and the occipito-nasal length of the skull 93; the winter coat is white or whitish, never grey as in the south Skandinavian form; the summer coat is lighter and greyer than in typical *timidus*. *L. timidus scoticus* agrees more nearly in size and appearance with the Alpine than with the Skandinavian forms; but it has shorter ears, is darker in summer, and is not known to become pure white in winter.

The subspecies of *L. timidus* decrease as a rule in size from north to south of the range of the species. This is also the case with the arctic hares of North America, where the northernmost subspecies of *L. arcticus* appear, judging from the published descriptions, to be larger than the southern. In Asia also *L. tschuktschorum* is larger than *L. gichiganus*, and *L. altaicus* is smaller.

Skull (range of nine specimens, eight in collection of the British Museum) :—Occipito-nasal length, 83.6 to 89; condylo-basal length, 76 to 81; zygomatic breadth, 43 to 47.4; breadth at inter-orbital constriction, 18 to 22.2; breadth at post-orbital constriction, 15 to 16.2; breadth of brain-case, 30 to 33; nasals (diagonal), 36 to 40.9; greatest breadth of both nasals together, 17.6 to 22.1; length of diastema, 23.2 to 27.7; length of mandible, 66.4 to 70; length of maxillary tooth-row, 16.6 to 18.2; length of mandibular tooth-row, 17.2 to 20.

Weight, in lbs. and oz. :—This is less than in the Brown Hare, and most Scottish naturalists give the average as between 5 and 6.

Harvie-Brown sends me the following :—Argyll—January, 6¹⁰, 6⁸, 5¹², 5⁹, 5⁸, 5⁸, 5⁴, 5, 4⁴, total nine averaging about 5⁹; August, 6⁴, 6, 5¹⁴, 5¹², 5¹², 5¹², 5², 5¹, 4⁶, total nine averaging about 5⁹; December, 6⁸, 6, 5¹², 5⁸, 5, 4⁸, 4⁸, total seven averaging about 5⁶; range of twenty-five Argyll specimens (some probably immature), 4⁴ to 6¹⁰, average about

¹ In each case including claws.

DIMENSIONS IN MILLIMETRES:—

	Head and Body.	Tail (to end of vertebrae).	Hind foot, with claws.	Ear.		Weight.* Lbs. Oz.
				To notch.	To nape.	
ADULTS IN COLLECTION OF BRITISH MUSEUM OF NATURAL HISTORY.						
MALES:—						
1. Cromlix, Dunblane, Perthshire, Capt. the Hon. A. Hay Drummond, 27th Oct. 1896. (No. 97.2.15.2)	492	60	135	68	..	..
2. Do., 29th Dec. 1896. (No. 97.2.15.5)	482	63	139	69	..	..
3. Do., 24th April 1897. (No. 97.5.13.1)	457	45	129	68	..	..
4. Do., 24th April 1897. (No. 97.5.13.2)	458	46	139	71	..	..
5. Do., 24th April 1897. (No. 97.5.13.3)	477	50	138	73	..	..
6. Cawdor, Nairn, Earl Cawdor, 31st Oct. 1898. (No. 98.11.2.1)	502	52	140	75	..	..
7. Altyre, Morayshire, Sir Wm. Gordon- Cumming, 24th January 1894. (No. 94.2.15.1)	500	63	130	..	..	..
8. Do., 2nd Dec. 1893. (No. 93.12.4.2)	485	57	127	..	..	..
9. Do. (No. 93.12.4.3)	501	64	135	..	..	..
10. Dallas Lodge, Forres, Sir W. Gordon- Cumming, 10th November 1900. (No. 3.1.27.1)	465	43	129	71	..	..
Average of 10 males	481	54	134	70.5 (Av. of 17 only)	..	..
FEMALES:—						
1. Cawdor, Nairn, Earl Cawdor, 31st Oct. 1898. (No. 98.11.21.2)	510	50	138	77	..	..
2. Do. (No. 98.11.21.3)	504	63	135	67	..	..
3. Cromlix, Dunblane, Perthshire, Capt. the Hon. A. Hay Drummond, 7th Dec. 1896. (No. 97.2.15.4)	470	62	132	70	..	..
4. Dumfriesshire, H. S. Gladstone, 22nd Aug. 1907. (No. 7.8.7.1)	520	67	145	78	..	..
5. Cairn Edward, New Galloway, Colonel Gordon Maitland, 24th Aug. 1895. (No. 95.10.6.1)	519	69	139	76	..	..
6. Do., 23rd Aug. 1895. (No. 95.10.6.2)	535	58	137	73	..	..
Average of 6 females	509	61	137	73	..	..
Average of 10 males and 6 females	492	57	135	72	..	..
SPECIMENS MEASURED BY A. M. RODGER.†						
MALES, weighing 5 lbs. and upwards.						
1. Pitlochry, Perthshire, 30th Jan. 1911	509	70	140	70	95	6 8
2. Do. do. do.	491	57	140	70	95	5 10
3. Do. do. do.	509	63	152	70	95	6 8
4. Do. do. do.	483	63	140	70	95	6 0
5. Do. do. do.	495	45	146	70	95	6 6
6. Logiealmond, do. do.	522	63	155	70	99	7 0
7. Do. do. do.	509	63	146	70	95	7 0
8. Do. do. do.	502	70	146	70	95	7 0
9. Do. do. do.	483	57	152	70	95	6 0
10. Do. do. do.	470	63	146	63	90	5 12
11. Do. do. do.	495	54	152	63	90	6 2
12. Do. do. do.	491	57	152	63	90	6 0
13. Do. do. do.	483	57	140	67	92	5 10
14. Do. do. do.	491	67	155	63	90	6 12
Average of 14 large males	495	60	147	67	93	6 4

* Weighed when some time dead.

† Measured down centre of back.

DIMENSIONS IN MILLIMETRES:—

		Head and Body.	Tail (to end of vertebræ).	Hind foot, with claws.	Ear.		Weight.* Lbs. Oz.
					To notch.	To nape.	
SPECIMENS MEASURED BY A. M. RODGER— <i>continued</i> .†							
FEMALES, weighing 5 lbs. and upwards:—							
1. Perthshire, 14th Oct. 1910	.	490	70	145	70	100	6 3
2. Do. do.	.	505	70	152	80	110	6 3
3. Do. do.	.	535	60	150	70	100	6 0
4. Do. do.	.	545	50	150	70	100	5 13
5. Do. do.	.	500	60	145	70	100	5 10
6. Do. do.	.	510	60	145	70	95	5 3
7. Do. do.	.	520	65	145	70	90	5 10
8. Do. do.	.	540	70	145	70	100	6 4
9. Do. do.	.	540	80	145	70	90	6 0
10. Do. do.	.	500	60	145	65	90	5 4
11. Do. 28th Oct. 1910	.	490	70	145	70	100	6 3
12. Do. do.	.	505	70	152	80	110	6 3
13. Do. do.	.	535	60	150	70	100	6 0
14. Do. do.	.	545	50	150	70	100	5 13
15. Do. do.	.	500	60	145	70	100	5 10
16. Do. do.	.	510	60	145	70	95	5 3
17. Do. do.	.	520	65	145	70	90	5 10
18. Do. do.	.	540	70	145	70	100	6 4
19. Do. do.	.	540	80	145	70	90	6 0
20. Do. do.	.	475	50	130	70	100	5 4
21. Do. do.	.	500	50	145	70	95	5 0
22. Do. do.	.	520	60	145	70	97	5 0
23. Do. do.	.	530	60	150	70	90	6 2
24. Do. do.	.	480	50	132	65	90	5 0
25. Do. do.	.	500	60	145	65	90	5 4
Average of 25 heaviest specimens		515	62	145	70	96	5 11
Average of 14 males and 25 females		508	61	146	69	95	5 14
26. Perthshire, 14th Oct. 1910	.	485	50	140	60	90	4 10
27. Do. do.	.	450	70	130	65	90	4 0
28. Do. do.	.	490	60	140	70	100	4 12
29. Do. do.	.	485	60	140	60	90	4 8
30. Do. do.	.	450	55	140	65	85	3 8
31. Do. 28th Oct. 1910	.	450	70	130	65	90	4 0
32. Do. do.	.	490	60	140	70	100	4 12
33. Do. do.	.	485	60	140	60	90	4 8
34. Do. do.	.	450	55	140	65	85	3 8
35. Do. do.	.	460	50	140	70	90	4 8
36. Do. do.	.	485	55	135	70	90	4 12
Average of 11 smaller specimens		470	58	137	65	90	4 5
Proportionate lengths (approx.) of adults, head and body being reduced to 100, and all other dimensions proportionally.		100	12	29	14	19	..

* Weighed when some time dead.

† Measured by tape-line along side of body.

5⁸; Stirlingshire—August, 7⁵, 6⁴, 6, 5¹⁴, 5¹², 5¹², 5², 5¹, 4⁶, total nine averaging 5¹¹; December, 6⁸, 6, 5¹², 5⁸, 5, 4⁸, 4⁸, total seven averaging 5⁶; range of sixteen Stirlingshire specimens 7⁵ to 4⁶, the whole lot averaging 5⁹. Heavier animals are, however, quite frequent amongst adults where food is abundant, the record being apparently 8⁸ (Millais, see below). There is much variability, dependent no doubt on the locality, the food supply, the numbers on the ground, and the presence of immature animals which always form a large percentage of the population.

Six killed at random by A. G. Cameron in North Argyll (*Field*, 9th January, 1904, 50) weighed:—two, 16th December 1891, 15; a female, 1st November 1892, 8; one, 17th November 1892, 8⁵; one, 22nd November 1897, 7⁸; one, 7⁴; average 7¹¹. Millais considers that 7 would be a good average weight, and 8 to 8⁴ not unusual; the three largest selected from a lot of two hundred at Dunalastair, Perth, on 30th October 1897, scaled 7¹², 8³ (female), and 8⁸ (female).

Distinguishing characters:—From *L. europæus* this hare may be distinguished at a glance at all seasons by its shorter ears. From *O. cuniculus*, which has also short ears, its small white tail and greater size, as shown especially in the hind feet, are distinctive; even in quite small leverets the tail is much shorter than a hind foot.

The cranial characters have been already given in such detail as to need no repetition (see above, p. 293-4).

The Scottish Blue Hare closely resembles the Brown in general habits, so that it will be here only necessary to notice the differences. This similarity has, no doubt, led to neglect of the former by naturalists, and, so far as can be ascertained, no comprehensive account of its life-history has yet been written.¹

All observers agree that in temperament it is a bolder (or, perhaps, more foolish and irresolute), as well as a more inquisitive animal; and in winter, should the snow melt, its whitish dress and lively habits make it very conspicuous. It often sits in full view, back to the wind, sheltered by an overhanging rock, or at the entrance of a hole or cleft amongst boulders or stones.² When startled it will run for a few yards, stop and sit upright to gaze wonderingly at the intruder; and then off it bounds again. But it soon halts, looks around for a few moments, and finally “hirples”³ away at leisure; which procedure suggests that in the past it has been accustomed to look for danger in the air, where it had enemies in the eagles, rather than on the ground.

In speed and agility it is rated inferior to the Brown Hare, and on its native moors can be run down by a smart collie

¹ See, however, “Fur and Feather Series,” *The Hare*, by several authors, 1896. J. G. Millais’s account of it is also to be praised. There are some notes on habits in Charles St John’s *Tour in Sutherlandshire*, ed. ii., 1884, i., III. Robert Collett’s exhaustive description of the very similar Skandinavian Hare is in Norwegian.

² Millais, iii., 34; T. A. Coward, *Zoologist*, 1901, 74.

³ George Sim, 70.

dog; but this is probably a question of food and condition, since in leg-dimensions it is proportionately superior.

The white winter pelage has been generally belauded as a remarkable instance of protective coloration, and, whatever may have been its origin, it may reasonably serve such a purpose in times or regions of heavy snowfalls. But elsewhere the effect is the reverse of protective, and Mr Coward has rightly pointed out¹ that this hare belongs to a class of animals which may for one reason or another find themselves in an environment to which their colour is quite unsuited.

Referring to the pigmented coat of the Brown Hare, Charles Darwin wrote² that "the hare on her form is a familiar instance of concealment through colour." Its value, however, may have been overestimated. The summer coats of the Leporidæ are not by any means alike, being grey in the Rabbit, ochraceous or rufus in the Brown Hare, "blue" or smoky brown in the Scottish, and tawny or foxy in the Irish Hare. In each, however, the chest, under side, and conspicuous ventral surface of the upturned tail are white. In each the new coats are darkest, becoming brighter and clearer as the dusky hair-tips wear away; the winter coats are greyer or whiter, and the pigmented areas are more or less reduced.

In no case are the animals protectively coloured for life amidst the green surroundings of the average modern British summer scenery; but their comparatively small size is in itself a factor of immense value for purposes of concealment, and the abundance of summer vegetation³ probably renders a coat of assimilative tints unnecessary.

In bare places, stubbles, or ploughed fields, amongst dead leaves, decaying herbage, lichens, or peat, concealment is more effectively secured; on the other hand, the Rabbit's pelage harmonises best with a background of sand.

¹ *Zoologist*, 1901, 75; see also G. A. K. Marshall on "Conscious Protective Resemblance," *Journ. cit.*, 1900, 536-549; E. B. Poulton, *Journ. et ann. cit.*, 550-554.

² *The Descent of Man*, ed. ii., 1889, 542.

³ A very important point, as anyone will appreciate who tries to course hares in grass of even moderate growth, in which even the keen-eyed greyhounds easily lose sight of their quarry.

Physiological necessities, chemical and climatic,¹ rather than the need of being inconspicuous, appear to have been the factors responsible for the evolution of these divergent pelages. Indeed it looks as if any shade of grey or brown must be equally valuable or valueless for protective purposes in summer. In the short, dark, winter days of the north the importance of any particular shade of colour is problematical, and in any case the white tints would be more advantageous against winged enemies hunting by sight in daylight, than against carnivorous mammals scenting their prey by night.

During the transition from summer to winter pelage, conspicuous white patches appear, apparently recapitulating a stage through which the animals passed in the course of their original attainment of the white winter coat. A protective whiteness would surely have been evolved by a general and uniform lightening of the entire pelage; and it looks as if any protective value which the change may possess is purely incidental.

The summer pelage is advertising, not protective, directly the animal moves, for then the quite brilliant white under side contrasts sharply with the pigmented upper surface. Even when viewed from behind, the white under parts being then invisible, the glistening upturned tail,² and, in the varying hares, the lighter bases of the ears, attract the eye. The suggestion is that the animals are coloured to be conspicuous in motion rather than for invisibility when at rest.

I cannot find that Mr Abbott H. Thayer's³ theory of obliteration through countershading is true for hares or for the Rabbit. The white chest, belly, and tail are particularly conspicuous whenever these parts can be seen, which is practically at all times when the animals are not squatting. But they habitually squat when danger threatens,⁴ especially

¹ See *Proc. Roy. Irish Acad.*, xxiv., B, 303-314, 1903; also F. C. Selous's views in *African Nature Notes and Reminiscences*, 1908, xiv., 11 and 41. These ideas are further elaborated in the article on the "Common Stoat."

² In the Rabbit the tail is also conspicuous when viewed from the front of the animal, as when it approaches *up* a hill. Viewed from behind, the black of the upper side sometimes shows up around the white under surface as a dark margin.

³ *Op. cit. supra.*, p. 223.

⁴ When in their forms they constantly jerk their heads up and down, and thus observe anything unusual while at some distance; they squat on the near approach of a possible enemy.

when they are in their forms, thus completely concealing the white parts of their bodies. So far from the white under side being oblitative, it is, if anything, an advertising factor, and shows up the animal from afar, as when one sits up on its haunches to "wash" its face.

The tameness of the Blue Hare, especially in the sexual season, renders it a constant source of annoyance to grouse-shooters by tempting their dogs to leave their legitimate business; in deer-forests it also meets with disfavour, as it alarms the deer, but here its numbers are thinned by eagles, foxes, and other carnivorous creatures,¹ which, by the modern policy of the sportsman, are encouraged on these preserves.

Unlike the Brown Hare this species will occasionally go to ground, and habitually hides in clefts of rocks or amongst large stones;² without, however, constructing permanent burrows or associating in warrens like the Rabbit. But that it may occasionally excavate temporary retreats for itself, was shown by Mr William Evans,³ who, in the hills of South Inverness-shire, inspected several short holes varying from two to five feet in length and some six or seven inches in diameter. These were stated to be the work of Blue Hares, and in one case at least there was enough fur adhering to the sides to prove the truth of the assertion; they were supposed to have been constructed in the first instance for the reception of the young; to the adults they could only be a temporary shelter, perhaps a sufficient protection against attacks by birds of prey, but of little value against carnivorous mammals. In the Moorfoot Hills also, where rocks are absent, Mr Evans is informed that the hares often burrow into the exposed faces of peat.

As winter approaches in cold districts the Blue Hare often leaves its summer haunts and descends in search of a more genial climate. In the same way, it resorts to the

¹ A point of great interest, the inter-relations of rodents and carnivores, as exemplified particularly in North America by the Snowshoe Rabbit and the Lynx, which depends on it for food, is discussed by Ernest Thompson Seton in *The Arctic Prairies*, 1912, 95, etc.

² A habit retained by the naturalised Blue Hares in England; see Coward, *Zoologist*, 1901, 75.

³ *Ann. Scott. Nat. Hist.*, 1892, 267. He has also seen a similar burrow in a peaty bank in central Perthshire (*MS.*).

sheltered sides of the mountains in severe weather, but generally makes for the hill-tops when disturbed. Such seasonal wanderings are purely local, and quite insignificant in comparison with the extensive migrations of hares which are reported to take place, for instance, in Siberia;¹ but, as stated above (p. 237), these movements are accentuated in exceptionally rigorous winters.

Its ordinary food is similar to that of the Brown Hare, but its stronger teeth must influence its diet by enabling it to utilise heather or other coarser forage. It is said also to feed in winter on lichens² and to chew up the cones of conifers to get at the seeds. Probably also, like the Skandinavian Hare, as described by Professor Collett, it may eat berries in autumn. Its stout fore legs enable it to remove snow from over its food.

Little has been published in connection with the sexual habits, period of gestation, and number of young. They are supposed to be similar to those of the Brown Hare, except that the Mountain Hare is erroneously³ believed not to produce more than two broods in the year.

There is probably much variation in this respect, due to climate, food, and season; Mr Millais shot females in full milk in September, and has seen many small leverets in that month. He thinks that these are the young of leverets of the previous year; but the facts point equally well to the occurrence of a third litter in the season. Professor Collett states of Skandinavian hares that the sexual season seems to be of variable duration. There many females produce young two or three times in the year, and some pregnant does may be found in every month. The number of young is also variable, but may be as many as eight.⁴

As early as February the female takes up a fixed place of residence, and awaits the male, who finds her by scenting

¹ John Bell (*Travels from St Petersburg in Russia to Diverse Parts of Asia*, 1763, i., 222, 224, and 231), early in March 1720, met with "prodigious" flocks of White Hares on migration near the river Yenisei and its tributary the Tongusta.

² John H. Dixon's *Gairloch in North-west Ross-shire*, 1886, 239.

³ Having regard to the habits of the Skandinavian Hare (Collett). As stated above (p. 168), the rule would seem to be, the farther north the fewer the litters and the larger the number of young in each.

⁴ The American "Snowshoe Rabbit," *Lepus americanus*, may have as many as ten (Thompson Seton, i., 631); and for the Greenland Hare, see above, p. 160.

her along the spoor; when hunted, therefore, at that season the female makes very short rounds, while the males may strike out widely.

As a rule during the rutting season, the male spends nearly the whole day wandering about, and pairs, as it is assumed, with several females, usually at night. Frequently rival bucks fight with each other for their mates, so that flecks of wool lie scattered about, and the snow is blood-spotted; in combat they use their incisor teeth and the sharp claws of the fore feet. The does often pair again while they are still suckling young, and superfœtation has been occasionally observed. The pairing shriek is a "hu-hu-hu," which can be heard from afar, but when suddenly aroused a hare may utter a hissing sound.¹

The Dogrib Indians entice the Hudson Bay Varying Hare² by uttering a rasping squeak through the closed lips. Adults of both sexes are attracted, but only during the summer or breeding season; the young seldom respond, and adults rarely a second time; but they may generally be made to return within a certain distance, apparently to get a second look at the intruder, and may then be heard scurrying about and loudly thumping their feet. Sometimes the approaching hare makes a grunting noise.

The flesh of the Blue Hare is usually considered inferior and unpalatable, but its quality is probably dependent on the food, since, like that of the Irish Hare, it is often excellent eating. For comparison it may be noted that the flesh of the Hudson Bay Varying Hare,³ although at all times innutritious, is very agreeable in summer; it is bitter in winter, at which season the animal feeds largely on the foliage and bark of resinous trees. Indians living mainly on those hares (at whatever season) describe themselves as starving, and are said to grow very thin if no other diet be obtainable.

¹ In default of British observations, the facts in the two preceding paragraphs are condensed from Collett.

² *Lepus americanus*, Erxleben—see E. A. Preble, *North Amer. Fauna*, No. 27, 1908, 200.

³ Preble, *op. cit.*, 201.

THE IRISH HARE.

LEPUS HIBERNICUS, Anon. in Partington.*LEPUS HIBERNICUS*, Bell.

1832. *LEPUS TIMIDUS*, John V. Stewart, "A List of, and Remarks on, some of the Mammalious Animals, and the Birds, met with in the Three Years preceding 4th December 1828, on the North Coast of Donegal," *Loudon's Mag. Nat. Hist.*, v., 1832, 579; Lydekker, *Handbook to the British Mammalia*, 1895, 225; Barrett-Hamilton, *Irish Naturalist*, 1895, 90; Thomas, *Zoologist*, 1898, 101; Aflalo; Johnston; Scharff, *Trans. Roy. Irish Acad.*, xxxii., B, iv., 199, September 1903, and xxxiii., B, i., 37, February 1906.
1833. IRISH HARE, William Yarrell, *Proc. Zool. Soc.* (London), 88; no definite locality or technical name given.
1835. *LEPUS TIMIDUS* var. β , IRISH HARE, Leonard Jenyns, *Manual of British Vertebrate Animals*, 35.
1836. "THE IRISH HARE, L[EPUS] HIBERNICUS," Charles F. Partington's *The Brit. Cyclop. Nat. Hist.*, ed. i., ii., 705; ed. ii., ii., 705, 1842; described from Ireland.
1837. *LEPUS HIBERNICUS*, Thomas Bell, *History of British Quadrupeds*, ed. i., 341; described from Ireland; MacGillivray; Thompson, *Trans. Roy. Irish Acad.*, xviii. (sci.), 260, 28th May 1838, 1839, and *Nat. Hist. Ireland*, iv., 19, 1856; Wood, *Illustrated Nat. Hist.*, "Mammalia," 1861, 584; Sanford, *Quart. Journ. Geol. Soc.* (London), xxvi., 1870, 127; Boulger, *Proc. West London Sci. Assoc.*, 26th October 1875, 29; Leith Adams, *Proc. Roy. Irish Acad.*, ser. 2, iii. (sci.), 99, 1883; Miller.
1837. *LEPUS TIMIDUS* var. *HIBERNICUS*, John Templeton, "Irish Vertebrate Animals: selected from the Papers of the late John Templeton, Esq., Cranmore. By Robert Templeton, Esq.," *Charlesworth's Mag. Nat. Hist.*, i., N.S., 404; named only, without description.
1840. *LEPUS VARIABILIS*, A. Graf Keyserling and J. H. Blasius, *Die Wirbelthiere Europa's*, i., vi. and 30 (part); Harvey, *Fauna and Flora of the County of Cork*, "Mammalia," 1845, 3; Clermont; Bell (ed. ii.); Leith Adams, *Sci. Proc. R. Dublin Soc.*, N.S., ii., 45, 84, 18th March 1878, and *Proc. Roy. Irish Acad.*, ser. ii., iii. (sci.), 99, 1883; Ball, *Sci. Trans. R. Dublin Soc.*, N.S., iii., 334, 18th May 1885; Flower and Lydekker; Lydekker, *Catalogue of Fossil Mammals, . . . in the Science and Art Museum* (Dublin), 1891, 15.
1857. *LEPUS VARIABILIS*, a *Form der wärmeren Klimate*, J. H. Blasius, *Säugethiere Deutschlands*, 420 and 424 (part).
1891. *LEPUS VARIABILIS HIBERNICUS*, G. E. H. Barrett-Hamilton, *Irish Sportsman*, 22nd August, 428; Hinton, *Sci. Proc. R. Dublin Soc.*, xii. (N.S.), No. 23, 8th September 1909, 257.
1900. *LEPUS TIMIDUS HIBERNICUS*, G. E. H. Barrett-Hamilton, *Proc. Zool. Soc.* (London), 6th February, 89; Millais; Hilzheimer, *Zool. Anzeiger*, xxx., 511, 14th August 1906; Trouessart.
1900. *LEPUS TIMIDUS LUTESCENS*, G. E. H. Barrett-Hamilton, *Proc. cit.*, 89, described from a yellowish variety from Donabate, Co. Dublin; Trouessart.

Synonymy:—There is here no trouble The name *lutescens* was applied by me to a yellow variety, which, however, although of con-

siderable interest, is not properly established geographically (see below, p. 334).

Terminology and local names:—See under *Lepus europæus* (p. 251).

History:—Hares must have been abundant in Ireland from pre-historic times. They take their place with other animals in the old hunting legends, and are mentioned in the tract “De mirabilibus Sacræ Scripturæ,” believed to have been written about A.D. 650, by the Irish ecclesiastic Augustin (*Proc. Roy. Irish Acad.*, vii., 1862, 518):—“Quis enim, verbi gratia, lupos, cervos, et sylvaticos porcos, et vulpes, taxones, et lepusculos, et sesquivolos in Hiberniam deveheret?” (“Who, for instance, would bring wolves, deer, and wood pigs, and foxes, badgers, and little hares, and ‘sesquivoli’ [for the meaning of which, see under *Squirrel*] to Ireland?” The use of the diminutive *lepusculos* instead of the ordinary *lepores* is curious, and it might at first sight be thought that this word had reference to rabbits. The meaning is, however, explained by a passage in Giraldus Cambrensis (*Topographia Hibernica*, cap. xxiv., A.D. 1183-1186), who wrote “Sunt et lepores multi, sed minuti; cuniculis quidem tam sui modicitati, quam delicata pilositate consimiles,” *i.e.*, “There are also hares, many but small; closely resembling rabbits indeed as much in their habits as in their soft fur.” Giraldus thus supplies the first written description of the Irish Hare; it is accompanied by the information that these hares had, like foxes, the remarkable habit of keeping to the woods and coverts when hunted, instead of taking to the open.

An early reference to the animal occurs in Hoveden’s *Chronica* (t. ii., 29, Rolls series), wherein it is related that when King Henry II. landed at Crook, near Waterford, for the conquest of Ireland on 17th October 1171, a white hare sprang out of some bushes, and, being immediately captured, was presented to the monarch as an omen of victory. This would be an exceptionally early date on which to meet an Irish Hare in complete winter coat, so that the animal may have been an albino.

In a list of Irish exports of about 1430, the skins of the “Irish Hare” appear, with those of other animals. (See above, p. 189, and also under *Squirrel*.)

Fynes Morrison, who lived in 1559-1603, described the Irish greyhounds as being so high that they overbear the hares, which were in “great plenty,” when they have turned them (Falkiner’s *Illustrations of Irish History and Topography*, 1904, 223 and 324).

In the *Ancient and Present State of the County and City of Waterford*, ed. i., 343, footnote, 1746, Charles Smith remarked that “it is no unusual thing even in this county to meet with white hares”; and there are many later references.

The attention of English zoologists appears to have been first drawn

to the Irish Hare by the then Lord Stanley, afterwards Earl of Derby, President of the Linnean Society. He exhibited a specimen at a meeting held 5th March 1833 (*Trans. Linn. Soc.*, London, 17, 555), and also provided Yarrell with specimens, whereby the latter naturalist introduced the species to the Zoological Society of London on the following 23rd July (*Proc. Zool. Soc.*, 1883, 88). William Thompson, being present at the meeting of the Linnean Society, stated that, although not hitherto published, the differences between the hares of the two countries were already well known in Ireland; but that Irish naturalists regarded the hare of Ireland only as a very distinct and well-marked variety of *Lepus timidus* (i.e. of *L. europæus*).

In 1835, Jenyns, in introducing the Irish Hare as a variety of *Lepus timidus* (which name he applied to *L. europæus*), remarked that it "might almost deserve to be considered as a distinct species." It was not, however, until 1836 that the animal received its specific name (*hibernicus*) in an unsigned article in Partington's *British Cyclopædia of Natural History*. This article antedates the first edition of Bell's *British Quadrupeds*, the description in which is usually cited as the authority for the species; possibly Bell wrote both. The species was accepted by E. T. Bennet in his edition of White's *Selborne*, 1837, 128 (without a technical name), and by MacGillivray, who, in 1838, published an excellent description of the animal taken from nature.

In 1839, Thompson, "on a very minute examination of Scotch and Irish specimens," published his agreement with Bell's conclusion (*Trans. Roy. Irish Acad.*, xviii., 260-271, 18th May 1838, reprinted in *Nat. Hist. Ireland*, iv., 19-26, 1856). Thompson's paper, although he ignores cranial characters, was for its date carefully drawn up, and it might have been expected that his opinion would command attention, formed as it was on the spot, and based on personal knowledge of all the British hares. In 1840, however, Keyserling and Blasius dismissed the species as not different when in summer pelage from *L. variabilis*, although not whitening in winter.

Thompson, perhaps influenced by Blasius, seems afterwards to have changed his position (see Harvey's *Fauna and Flora of Cork*). In 1857, Blasius submitted that the Irish Hare might be a "Form der wärmeren Klimate," but he united it with the quite different hare of southern Skandinavia. This lead had an unfortunate effect, and the animal was subsequently regarded pretty generally by authors either as a "climatic race," or its identity with *L. timidus* was taken for granted. It was thus treated by Alston and Tomes, by Friedel (*Zool. Garten.*, xx., 311, 1879), and, more recently, by Lydekker and by Johnston. It appeared as a species in Wood's *Natural History* in 1861, and in a note in the *Field* of 11th July 1874, 31, T. E. Davies remarked on its size, colour, and fineness and length of leg. In 1891 I suggested

that it might eventually be regarded as a subspecies, but I had arrived at no more definite conclusion in 1895 (*Irish Naturalist*, 90), nor had Thomas in 1898.

In 1900 I definitely assigned it to subspecific rank. The subspecific rather than the full specific rank was considered appropriate because it was thought possible, although there was no evidence of it, that there might be overlapping of characters with the Scottish Hare. Moreover, my work dealt with the varying hares of the old world as a whole, so that it was convenient to regard them all as subspecies; lastly, the trend of opinion of naturalists at that date was such that the announcement of a full species from Ireland would have been accepted with incredulity. In proof of this, the works of some recent writers, such as Johnston and Aflalo, are written as if such a species as the Irish Hare had never been mentioned, while Millais, although accepting it, does so only in an apologetic manner and with a hint that the "Irish Hare has slender claims to subspecific rank" (iii, 39). This too, although he prints shortly afterwards Harvie-Brown's statement (*Fauna of Argyll and Inner Hebrides*, 1892, 44), that in the island of Mull the Irish and Scottish Hares "appear to co-exist, and are recognised, by inhabitants at least, as very distinct varieties, if not species." Even writers on Irish Natural History, such as Scharff, treated the animal with a want of sympathy which, in politics, would have been styled unpatriotic.

Status:—In the present work the Irish Hare is given full specific rank because it is a completely isolated form of considerable antiquity, which owes its survival to preservation from competition in an insular area; it is absolutely distinguishable at a glance from its nearer relatives, with which it cannot naturally intermingle and never intergrades or overlaps in characters. When transported to localities inhabited by other hares, as the island of Mull, and Vaynol Park, North Wales, it retains its distinctness. It appears to have directly descended from the late pleistocene *L. anglicus*; the relationship implies a geologically recent connection between England and Ireland.

Distribution:—This hare is restricted to Ireland, where it is found naturally all over the country, both in the mountains and in the plains. Its numbers depend on the amount of persecution to which it is subjected; it has been exterminated in many districts, but, owing to the popularity of coursing, is increasing in others.

It is not known to be indigenous to the smaller coastal islands, though included by Drummond in a list of Rathlin Island mammals compiled in 1835. It has been recently introduced on Clare Island.

It has been introduced into various localities in England, Wales, and Scotland, and large numbers are said to be exported annually for coursing from one estate in Co. Down (Warrant, *Zoologist*, 1895,

104). The High Gosforth Park Coursing Club, Newcastle-on-Tyne, imported the following live hares, mostly from the Wicklow mountains :—In 1886, 262 ; 1887, 193 ; 1888, 199 ; 1889, 342 (E. Britten, secretary ; see also below, p. 339). In Islay some were turned down previously to 1818 (Thompson). In Mull there is a colony emanating from twelve hares sent from Wicklow about 1860 (Notman, *Field*, 10th January 1903, 53) ; here Irish and Scottish Hares may be seen together and keep their specific characters, the Irish retaining their reddish pelage, greater weight, and turning white in winter less readily than the Scottish Hares ; they also exhibit a tendency to the familiar buff variety, which I named *lutescens* in 1900 (see below, p. 334 ; also, Barrett-Hamilton, *Irish Naturalist*, 1898, 75).

A well-known introduction is that of the late G. W. D. Assheton Smith at Vaynol Park, Bangor, North Wales, which L. V. Lort thinks took place about 1881 ; new blood was added in the shape of thirteen bucks and eleven does from Caledon estate, Co. Tyrone, on 27th January 1899 (Lort per Forrest). A specimen from Vaynol in the British Museum is partly of the usual reddish colour, having changed three parts white. All three British hares are, or were, found in or round Vaynol Park, but Lort reports that the Irish are now nearly extinct.

There must have been many other introductions ; *e.g.* in Yorkshire (see below, p. 340). An Irish Hare is said to have been shot at Barnstaple, Devon, on 1st January 1902 (Tegetmeier, *Field*, 18th January 1902, 73).

Distribution in time :—Numerous remains of hares were found in the Shandon (Brennan, Carte, Leith Adams) and Ballinamintra caves, Co. Waterford (Leith Adams) ; in all the strata of the Coffey and Plunkett caves, Co. Sligo (Scharff, *Trans. Roy. Irish Acad.*, xxxii., 1903, B, iv., 199) ; in the Catacombs, Alice and Gwendoline, Newhall and Barntick caves, Co. Clare (Scharff, *Trans. cit.*, xxxiii., 1906, B, i., 37-38). Although not all of pleistocene age, many of the remains are undeniably ancient and contemporaneous with those of mammoth, reindeer, gigantic Irish deer, common and banded lemmings, arctic fox, spotted hyæna, bear, and probably of other animals, in a fauna of late pleistocene age corresponding with that illustrated by Ightham fissures, Kent. They have long been recognised as too large for *L. europæus*, and have therefore been referred to *L. hibernicus* (as by Leith Adams, *Trans. cit.*, xxvi. (sci.), 1879, 211). Femora from the Sligo caves measure 125 and 130 mm. and a tibia 145 mm. in length ; femora from Newhall and Barntick, Co. Clare, vary between 117 and 131 mm., tibiæ between 129 and 149.5 mm., which dimensions agree fairly well with those of modern specimens of *L. hibernicus*.¹

¹ The literature of the older caves is so extensive that it is impossible to give more detailed references.

Description:—The Irish Hare differs from the Scottish in its larger size, generally russet colour, not smoky brown or "blue," and in its irregular assumption of a white winter coat. It has longer ears and skeleton of the tail (although the actual fur of the Scottish Hare may be longer); flatter inter-orbital region; less highly elevated superciliary processes; longer, broader, and heavier incisors; and longer and stouter molars.

The arrangement and annulation of the fur and the general colour pattern of the body, tail, and ears are the same as in the Scottish Hare, but the dark browns of that species are represented by richer tints near "tawny," "tawny ochraceous," or "ochraceous." Owing to the fact that a white hiemal coat is only partially assumed, the ochraceous hues may become exaggerated, both in old and young, as the hairs of the winter coat grow old and their black tips wear away, so that they often appear as "red as a fox." In fresh pelage, on the other hand, the black tips are more prominent and the general colour is deeper and darker. In the pigmented coat the line of demarcation is comparatively definite. The whiskers may be black or white. The soles are brownish.

Leverets at birth are about the size of rabbits at the twelfth or fourteenth day, and probably weigh about 2 oz.; they have very short, broad, almost triangular ears, eyes less prominent than in adults, head markedly round, and underfur much more abundant than hairs. For the first few days they resemble rabbits, but have larger ears and feet, shorter tails, and lighter coloration; they are also more woolly, especially in early spring, when the coat is very thick. Their colours are variable even in the same litter, but are quite different from those of adults. In the first coat the underfur is about equally bicoloured, the bases being dusky, the distal ends of a tint similar to the subterminal bands of the long hairs; the latter are much lighter and less rich than in adults, being lighter than "isabella colour" or "clay colour," or approaching "buff"; in some specimens the tints resemble those of *L. europæus*. As the animal grows the light tips become longer at the expense of the dusky bases. The rump, tail, and ears present the same pattern as in adults, but the amount of grey on the latter varies or may be nearly absent. The tail is darker than in adults, and may be heavily sprinkled with black hairs on both sides; it whitens gradually. As the animal advances to maturity its tints become richer, commencing with the upper side of the head, but quite large animals are still in an intermediate condition, evidently representing a post-juvenal coat. Leverets with the hind foot measuring 100 to 105 mm. (including claws) were found to be in the lightest stage; one with the hind foot 118 mm. was intermediate; one killed in January with the hind foot 134 mm. had not acquired a fully adult appearance, neither had a male, weighing 6 lbs. and with the hind foot 137 mm., killed early

in September 1910, nor yet another weighing 7 lbs. in November of the same year; in all these the skull was found to be immature.

In winter the animal is to a variable, but, as a rule minor, extent white. The rump, flanks, legs, and backs of the ears are most frequently whitened, the face is often affected and the eyes ringed. Rarely (yet sometimes even so far south as Wexford or Waterford) the whole upper surface becomes almost white, leaving only portions of the head brown. Usually "islands" of brown colour remain on the back, and the constantly present sprinkling of reddish hairs serves to distinguish the Irish from the Scottish Hare.

The feet (see Plates xix. and xx.) are not so thickly furred as in *L. t. scoticus*.

Winter whitening:—In 1746 white hares were mentioned by Charles Smith (*op. cit. supra*, p. 326); and, since the time of William Thompson, the fact has been well known that the Irish Hare may and often does undergo a considerable change in winter. This takes place to some extent every year as well as all over the country, but frequently escapes notice except in its more conspicuous stages. In spite of this, the statement has often been made until quite recently that the Irish Hare does not turn white in winter.

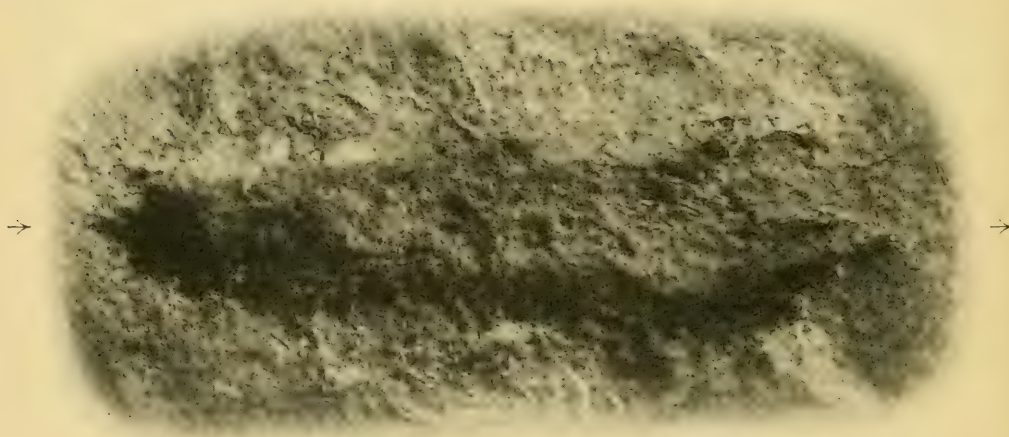
Thompson gave instances of whitening occurring in hares from the north-east to the south-west of Ireland. The whitest he had ever seen was sent to the Belfast Museum from Glenarm Castle, Co. Antrim, in January 1845. It was "even whiter than a winter Alpine one obtained in the same season." In a note sent to Robert Patterson by Lord Antrim from the same locality, it is stated that in the cold, snowy winter of 1878-79 large numbers of hares of all ages turned "completely" white, both on the hills and the low grounds, and remained so until the end of April. Thompson also mentions a "white hare" seen in Massareene deer park in the same county in December 1847; this individual had been white in the previous winter. That these were not isolated instances is shown by a report received by Thompson from Tollymore Park, Co. Down, on 8th March 1845, that there were "a great number of white hares on the mountain; some of them snow-white"; and in February 1842 Thompson had himself inspected several partially white hares from Shane's Castle Park in Co. Antrim. F. J. Montgomery also wrote (*Field*, 16th March 1907, 445), that hares very often turn white in Co. Antrim, particularly on the mountains and in severe winters. From the south of Ireland Thompson had reports of two killed in an advanced stage of whitening, near Clonmel, between Cos. Tipperary and Waterford, and near Mitchells-town on the Tipperary border of Co. Cork. He had also a record of the occurrence of winter whitening, although irregularly, in Co. Kerry.

Thompson was corroborated by T. E. Davies, who wrote (*Field*, 11th July 1874, 31), from Buncrana, Co. Donegal, that in Cos. Derry and Donegal the hares often turn white, except a few hairs on the head and tips of the ears; by Edward Ker, who spoke for the Mourne Mountains, Co. Down (*Journ. cit.*, 18th July 1874, 81); and by Lord Clermont. The latter reported (*Zoologist*, 1882, 107) a very decided annual change of colour from the summer to the winter garb in the hares at Ravensdale Park, on the borders of Cos. Armagh and Louth, and that the white prevailed more in hard than in mild winters. Warrand also pointed out (*Journ. cit.*, 1895, 104) that at Finnebrogue, near Downpatrick, Co. Down, while nearly all assume a much lighter shade of fur when the cold weather sets in, a considerable number turn very white; but Maxwell, the owner of the property, informs me that extreme stages of whitening are rarely reached. To these records may be added Cos. Galway, Wicklow, Wexford, Waterford, and Monaghan, the latter on the authority of my correspondent James Brodie. In Wexford some individuals turn remarkably white almost every year even at sea-level on the rich pastures of Kilmanock. From Kilmacthomas, Co. Waterford (see also Smith, quoted above on p. 331), I have seen one of the whitest Irish Hares known to me; one from Co. Wicklow, and another (a very white doe) from Ballybrophy, Queen's Co., are in the Dublin Museum. From Galway there are many records; for instance, Whyte reported that of five hundred and eighty-two hares killed in two days, ten were white or nearly so (*Field*, 12th February 1876, 158); he thought the animals turned whiter on grass than on heather (*Journ. cit.*, 25th July 1874, 87); in the Kylemore townland the late G. H. Kinahan (*Land and Water*) shot during one winter at least twenty piebald hares, some nearly white; and one "perfectly white" was seen near the top of Derryclare, one of the Twelve Pins (Caton Haigh, *Zoologist*, 1895, 185-186). Others in similar condition have been observed near Bruff, Co. Limerick. Lastly, Harting (*Zoologist*, 1895, 104 and 149; also *Field*, 29th August 1891, 331-332) has examined a number of Irish Hares in all stages from brown to white.

As stated above, winter whitening in the Irish Hare is very irregular in its action. It is evident that few individuals whiten by habit, and that the amount of stimulus required to cause whitening is in each case very variable. Thus, on a given area occupied by a number of hares a few will turn very white, a number conspicuously although only partially white, while others will have only whitened a little. Apart from individual constitutions, the degree may depend on the locality or ground, since Whyte (*op. cit. supra*) wrote that in his district all the white hares were killed on the lower ranges of green limestone, and he never remembered to have seen a white one on the heathery hills. In Connemara Kinahan found the hares whitening more



(1) *A.* (2)



B.

TRACKS OF, *A*, HEDGEHOG, (1) left fore, and (2) left hind, foot (artificial imprint, life size);
B, IRISH HARE (left hind foot, natural imprint, reduced in size), Kilmanock, 1910,
 showing the whole length of foot placed on the ground.

or less on the Banneobela range, but not in some other parts. Again, the hares in some enclosed parks are believed to be particularly subject to whitening, which in such cases has been attributed to deterioration caused by inbreeding (thus Pomeroy in Harvie-Brown and Buckley's *Fauna of Argyll and Inner Hebrides*, 1892, 43, footnote).

The white may begin in patches, which then show up in strong contrast to the portions of the coat which remain pigmented; or it may take the form of a gradual bleaching over the whole body. Young animals seem to show as much irregularity as adults.

There is some evidence to show that on the whole does whiten more readily (and retain the white pelage longer) than bucks. Years ago the late G. H. Kinahan found (*Land and Water*) that in Connemara in March he could tell bucks and does by their colour alone, and the conclusion reached at Kilmanock is similar.

Within the above limits whitening is dependent on temperature, being more prevalent in hard than in mild winters (see *Zoologist*, 1882, 107); but not always clearly so, since in some mild seasons a few individuals may attain to a conspicuous degree of whiteness.

At Kilmanock the white appears at no very regular period, but never before December, and sometimes later. Individuals seem on occasions to whiten slowly, but at other times so rapidly that to suppose that the change is caused by a moult is inconceivable; indeed I have found a moult on 9th November 1910, before the whitening season.

Having once whitened, an animal remains so until the next moult, which may be postponed until some time during the first half of May, and apparently is often late in animals which have whitened to an exceptional extent. The date of the spring change is very irregular, and I examined whitened hares in process of moult and changing back to brown, on 20th and 21st January 1910. A very white female in the Dublin Museum from Ballybrophy, Queen's Co., labelled February 1901, is also moulting from white to brown.

Irish Hares introduced at Vaynol, near Bangor, North Wales (see above, p. 329), are said to become more or less white as a general rule (Ed. of *Field*, 1st August 1891, 174). In Mull they do not turn white as readily as the Scottish Hares.

Thompson mentions a hare which, after having been white in winter, was easily recognised by its light colour in the following summer.

The **skull** is similar to that of *L. timidus scoticus*, but larger (see table of dimensions); it shows primitive characters in the flatter inter-orbital region, and less conspicuously elevated superciliary processes.

In the **teeth** the incisors are longer and heavier than in any other British Hare, though not so broad as in *europæus*; the molars are long and stout. The mandible (Fig. 48, p. 315) is consequently very deep, and the growing ends of the lower incisors overlap the anterior cheek-

teeth. The above cranial and dental features are emphasised in the late pleistocene *L. anglicus*.

Exceptional variation:—Blackish or sooty varieties occur occasionally, and several instances are on record, *e.g.*:—one, Co. Kildare (Thompson); another, same county, December 1889, with the central dorsal region black fading into blackish grey on the flanks, but the sides of the mouth and a small space around the eyes normal (E. Williams, *Zoologist*, 1890, 70); one, described as “perfectly black,” shot near Belturbet, Co. Cavan, in 1878 (Williams and Sons, *Zoologist*, 1878, 434); one, at Garrycloon, Ballina, Co. Mayo, 1892, examined by me at Williams and Sons; a breeding doe, weighing 8 lbs. 10 oz., now in the British Museum, purchased, Waterford, 7th January 1911; one in the Dublin Museum from Queen’s Co.; and there have been others (see Dennehy, *Field*, 27th May 1905, 905).

A well-marked buff variety, first reported by A. Williams from the midlands, and also noticed in Galway (Millais), became numerous along the coast from Malahide to Balbriggan, Co. Dublin. The upper side is rich buff, the under side white, the eyes pale straw-yellow with a greenish tint, and the black ear-tips are absent. The variety appears to breed at least partially true, since mother and young have been taken together (E. Williams, *Zoologist*, 1890, 70-71); for this reason I named it *Lepus timidus lutescens* (see *Synonymy*), but the name has not been accepted, and the variety can hardly be regarded as of subspecific value. It crops up occasionally amongst the Irish Hares introduced into the island of Mull, and has been noticed amongst Scottish Hares at Tellyfour, Aberdeen (see Haggard, *Field*, 31st October, 693; Fenton, *Journ. cit.*, 21st November 1896, 814).

A permanently grey or whitish variety (of which a specimen is in the Dublin Museum), without black ear-tips, but with pigmented eyes, arose in Co. Armagh as the produce of a single white individual. This was first observed as a leveret in 1885, and in 1887 was netted and turned down at Castle Dillon, where, the same year (according to G. D. Beresford), it produced two leverets, one grey and white, the other white like the original. In 1890 there were seven hares, evidently bred from the white hare—six white, and one a parti-coloured grey and white animal. Four died during the winter and spring, and there were left in July 1891 three, the original hare, another white one, and the parti-coloured one already mentioned. These hares never changed colour, but always remained the same as when born. In 1891 no leverets were born, and the old doe was then about seven years old.

Both old and young may exhibit the white frontal spots already mentioned as occurring in the other British species of *Leporidæ*.

Sexual differences are very evident in this species, the males having

the head comparatively thicker and shorter, and the ears apparently shorter than the females.

Local variation:—There is a general impression amongst sportsmen that hares inhabiting the mountains differ from those found in the plains, but little definite information is available. Kinahan, writing of Connemara, mentioned "the short, small hares that do not seem to care for running and always dodge about between the rocks and crags" in contrast to the "long springing sort, that will run when started" of the Banneobela range (*Land and Water*); and Whyte suggested that the hares of the heathery mountains of Galway are not identical with those of the green limestone (*op. cit. supra*). Further study on this and other kindred points is desirable.

Skull (range of five specimens of both sexes):—Occipito-nasal length, 91 to 98.6; condylo-basal length, 82 to 86; zygomatic breadth, 44.4 to 48.4; breadth at inter-orbital constriction, 22 to 23.4; breadth at post-orbital constriction, 14 to 17.6; breadth of brain-case, 32 to 33.8; nasals (measured diagonally), 39.4 to 42.8; greatest breadth of both nasals together, 19.4 to 22.1; length of diastema, 26 to 28.4; length of mandible, 73.4 to 74; length of maxillary tooth-row, 18 to 18.8; length of mandibular tooth-row, 18.6 to 19.2.

Weight (in pounds and ounces):—Fully adult females in good condition killed on the rich, low-lying pastures of Kilmanock, Co. Wexford, may reach 9 or a little more, the heaviest ever handled being nearly 9⁴, but these weights are exceptional and, as shown in the tables, the average is much less. The largest bucks are lighter, the two heaviest being only 8. The above figures are probably true of lowland hares all over Ireland, since Pomeroy (*op. cit. supra*, p. 333) gives 9 as the limit for Galway, with good hares slightly exceeding 8, but a great many little over half that weight, especially on the heather, where Whyte also found them lighter than on the green hills (see *Field*, 25th July 1874, 87, a very similar note to Pomeroy's). From Monaghan, Kane wrote me that they "run to a great weight, sometimes 9 lbs. and even more." Sixty-three killed at Ballypatrick averaged 7, but in Glenarm Park demesne, both in Co. Antrim, they often reach 9 (Lord Antrim, per Robert Patterson). The introduced hares of Mull are also said to equal about the same weight; according to Millais they frequently scale 8, and the largest known 9.

Weights greater than 9 must be very rare, but Meade-Waldo informs me that in the winter of 1895 he received one (sex not stated) scaling 10, from Ards, near Letterkenny, Co. Donegal; Lord Antrim has known of a single one reaching a similar figure in Glenarm Park demesne, and these would appear to hold the record for the species.

It will be noted from the tables that several males of 6 and two females

DIMENSIONS IN MILLIMETRES:—

	Head and body.	Tail.		Hind foot, with claws.	Ear.		Weight. Lbs. Oz.
		With terminal hairs.	To end of vertebrae.		To notch.	To nape.	
SPECIMENS FROM KILMANOCK, CO. WEXFORD (killed 17th Jan., measured 18th Jan. 1911).							
FULLY ADULT MALES:—							
1.	559	143	81	165	74	104	7 8
2.	533	133	82	159	71	95	7 0
3.	546	149	76	149	72	97	7 0
4.	546	124	75	159	75	95	7 0
5.	559	124	70	156	71	97	7 0
6.	559	133	80	152	76	108	7 0
7.	546	124	75	165	70	98	7 0
8.	559	140	77	168	75	98	7 0
9.	533	133	74	159	76	100	7 0
10.	546	118	70	159	79	102	7 0
11.	546	121	76	156	75	95	6 8
12.	..	133	81	152	71	96	6 8
13.	533	127	78	152	69	98	6 0
14.	546	133	74	159	71	100	6 0
Average (approximate) . . .	547	131	77	158	73	99	6 13
YOUNG MALES:—							
1.	546	133	75	163	80	104	6 0
2.	533	118	71	149	69	92	6 0
3.	508	124	79	152	79	97	6 0
4.	521	121	74	149	75	95	6 0
5.	546	136	73	152	78	102	5 8
FULLY ADULT FEMALES:—							
1.	559	121	71	165	81	108	8 0
2.	533	111	77	156	81	101	8 0
3.	533	120	77	156	76	99	7 8
4.	533	110	70	159	75	97	7 8
5.	533	125	79	162	80	104	7 8
6.	559	112	72	159	79	100	7 4
7.	559	130	70	152	79	110	7 0
8.	546	112	72	152	69	94	7 0
9.	546	124	69	156	75	98	7 0
10.	546	118	65	152	79	107	7 0
11.	521	..	..	156	76	95	7 0
12.	533	108	66	156	72	109	6 8
13.	559	111	79	156	78	108	..
Average	543	117	72	156	77	102	7 4
Average of 27 of both sexes .	545	124	74	156	75	100	7 0
Approximate proportionate lengths of adults of both sexes, head and body being reduced to 100, and all other dimensions proportionally .	100	..	13.5	28.6	13.7	18.3	..
Leveret (sex uncertain), 7th August 1911, hind foot very well haired; ears much shorter than head . . .	200	35	30	..	40	45	..
Leverets, about 21 days old, born in captivity at Kilmanock	224	35	25	60	38	45	{ 0 7 0 6.5
Weight at birth estimated at . .	..	..	..	..	..	..	0 2

N.B.—44 males killed by coursing at various dates, and not specially selected, averaged 6 lbs. 8 oz., with maximum 8 and minimum 5 (see *Irish Naturalist*, 1912, 234).

DIMENSIONS IN MILLIMETRES:—

	Head and body.	Tail.		Hind foot, with claws.	Ear.		Weight. Lbs. Oz.	
		With terminal hairs.	To end of vertebræ.		To notch.	To nape.		
SPECIMENS FROM KILMANOCK, CO. WEXFORD— <i>Continued.</i>								
YOUNG FEMALES:—								
1.	.	533	115	66	156	76	107	6 8
2.	.	533	105	72	156	70	99	6 8
3.	.	508	102	66	152	70	103	6 0
4.	.	521	112	69	152	73	110	6 0
5.	.	533	118	77	152	73	99	6 0
6.	.	533	121	77	152	71	108	6 0
7.	.	533	123	76	153	82	113	6 0
8.	.	483	78	56	140	69	97	5 0

N.B.—53 females killed by coursing at various dates, and not specially selected, averaged 8 lbs. 5 oz., with maximum 9 and minimum 6. Six of both sexes, specially selected as the largest amongst a number, 22nd February 1899, averaged 7, with maximum 8 and minimum 6 lbs. 5 oz. (see *Irish Naturalist*, 1912, 234).

of 6^s were considered to be not fully adult, and an immature male of 7 is mentioned above, on p. 331.

Distinguishing characters:—The ochraceous or tawny, instead of smoky brown colour is at all seasons distinctive as between the Irish and the Blue Hare, while as between the Irish and the Brown Hare the same points of distinction may be used as those laid down for distinguishing the Blue Hare. The cranial characters are given above, on p. 333.

To show the difference between the two groups *Eulagos* and *Lepus*, a subadult Brown and an adult Irish Hare were photographed in the same position (Plate XXIII.). The specimens were chosen because they were of about the same weight, an adult Brown Hare being too large for purposes of comparison. In these two specimens the actual body length was about the same, but its depth was slightly greater in *europæus*, in which animal also the hindquarters appeared to the eye to be more massive. In *hibernicus* the head is markedly larger, both in length and breadth, besides being more rounded; the eye is rounder, the ears markedly shorter, but the dimension of head and ears together is slightly longer in *europæus*. Every part of the limbs is longer in *hibernicus*; and, to show that this is not peculiar to the specimen of *europæus* used for comparison, the corresponding dimensions of an exceptionally large and fully adult *europæus* are added for comparison. In not one dimension of limbs or skull did this large specimen exceed the much lighter *hibernicus*.

L. hibernicus is, except in head, a more finely built animal, with longer legs, lighter bone, and less massive body.

	<i>L. hibernicus</i> , Kilmanock, Co. Wexford.	<i>L. europæus</i> , Poynett's, Bucks. (A. H. Cocks.)	<i>L. europæus</i> , Capernoch, Dumfries. (H. S. Gladstone.)	<i>L. anglicus</i> , (Pleistocene of Ightham).	<i>L. anglicus</i> , (Pleistocene of Ightham).	<i>L. t. scoticus</i> , Capernoch, Dumfries. (H. S. Gladstone.)	Corstopitum specimen.
Sex . . . {	Adult Male.	Subadult Female.	Old Female.				
Weight, 16th Jan. 1912 . . {	7 lb. (weighed warm)	7 lb. (weighed cold)	about 9 lb. (weighed cold)	..	..	..	..
From tip of nose to end of claws of hind feet . . .	711	711	..	..	..	..	..
From tip of nose to base of tail .	520	520	..	..	..	..	..
From tip of nose to end of ears .	203	209	..	..	..	..	..
Depth behind shoulder, meas- ured in a straight line, not round the curves . . .	152	165	..	..	..	..	..
The same, just before the thighs .	139	139	..	..	..	..	..
Length of a hind foot (including claws) . . .	149	143	..	..	..	..	..
Skull, extreme length . . .	97·2	90·6	99·4	110	103	95·7	..
Humerus, do.	107·3	97	102·7	(Somerset)	115·8	105·8	..
Radius, do.	110·8	103·8	108·3	..	120·5	108·3	..
Ulna, do.	126·34	119·3	..	..	..	123	..
Femur, do.	128·2	119·7	124·6	..	140·9	127·5	..
Tibia, do.	145·8	135·7	143·6	154·6	145·5	145	152·7
Do., in articular length (inner side)	140·2	130·9	138·3	..	..	139·6	146·6
Metatarsal III, length . . .	56	50·8	53·5	59·7	55·2	55·2	..

The habits of this species probably do not differ much from those of the Scottish Hare. When accustomed to human beings, it becomes anything but timid, and at my own home there are few hours of the day or night when from one up to (occasionally) a dozen may not be seen grazing within a stone's throw of the house. Very often they will not take the trouble to retire on the approach of a human being, and their tracks show that in the night they wander quite close to the house and even ascend the hall-door steps. Even if chased by a small dog they will frequently sit bolt upright to reconnoitre their pursuer. It is a pretty sight when a party of these beautiful animals are feeding at close range in perfect confidence, and in spring their movements are particularly attractive. At that season they are unusually in evidence, and go through many antics—boxing, kicking, bucking, dodging, leaping sideways, sniffing at each other nose to nose, or rushing madly round in a circle. Then after a general scurry they settle down to feed, scraping away snow (if present) with their paws; or they may roll on their backs or stretch themselves at full length on the ground. In March 1909 two pursued a large domestic cat of colour somewhat resembling

themselves; the pursuit was sustained so hotly across the lawn and through a shrubbery that more than one person witnessed it independently; a possible explanation may be that these were two males so blinded with "March madness" as to mistake grimalkin for a member of their own race.

The eyesight cannot be very good, at least not as compared with that of man, dog, or fox. Although a hare, when not lying in her form, will see and move away from a man while still several hundred yards away, she often does not notice a motionless observer, even if he is standing in the open, and will approach him quite closely without suspecting his presence. On such an occasion one has fed a little quite close to me, lingered to clean herself, and passed on without having perceived me. At other times individuals have been so near that their twitching nostrils were plainly visible.

In relative speed, activity, and endurance, the three British hares, when well fed and on suitable ground, are not known to differ widely, though, as might be expected, the Blue Hare is inferior when half starved in winter on a diet picked up on the mountains. William Thompson was informed that the only noticeable distinction between the Irish and Scottish Hares is that the former goes off faster from greyhounds than the latter, and is thus less likely to be killed at the first dash; but there are few opportunities of comparing these two species.

The Irish and the Brown Hares are more often seen together, since each of them has been introduced into the territory of the other. People who have observed them side by side seem puzzled to clearly distinguish their powers; and in England¹ the Irish are considered quite as good for coursing purposes as the local hares, as shown by the large number now exported.² At Trabulgan, Co. Cork, Brown Hares were for two seasons coursed side by side with the native hares, which the first Lord Fermoy believed that they outpaced until the greyhounds reached them, probably owing to their greater size and longer

¹ As at Gosforth Park, Newcastle-on-Tyne, *vide* T. Snowdon; see *Irish Naturalist*, 1898, 76. Brown Hares introduced at Strabane, Ireland (see above, p. 329), are said to be, in comparison with the Irish, "bad soft runners" (D. Ker, *in lit.*; see also some notes in *Field*, 14th April 1888, 527).

² *E.g.* from Finnebrogue, Co. Down, see the late Major-General W. E. Warrand, *Zoologist*, 1895, 104.

stride. But when closely pressed the Brown Hares were not nearly such good performers as the Irish, "as the latter turns in so much smaller space, is so much quicker off the turn, and is so very stout-hearted. She is never beaten until the greyhound has her in his mouth." This is a plausible view, and agrees with the anatomical distinctions between the two animals—the lighter body but longer legs of the Irish Hare.

As regards the powers of the Irish Hare when hunted by harriers, Mr Reginald Graham,¹ who turned down some at Norton Conyers in Yorkshire, believed them to be faster and stouter than the Brown Hare.

In actual speed all hares are, except on favourable ground,² very inferior to greyhounds and doubtless also to racehorses,³ which are the only breed of horses capable of being brought into a fair comparison. It is therefore not surprising to find that the late Colonel Thornton, of Thornville Royal, who died in 1823, is credited with having ridden down a Brown Hare at Newmarket in the presence of a large concourse of people; and that the late Allan McDonogh, a noted steeplechase rider, many times on the Curragh of Kildare turned (presumably Irish) hares after a quarter of a mile's gallop on a chaser. The failure of Mr J. E. Harting⁴ to overtake the hares of the Wiltshire Downs was no doubt due to the fact that his horse, although good, was "not a remarkably fast one." But a race between a horse and a hare must be regarded as a somewhat unsatisfactory contest, the result being largely dependent on the length of the course, the breed of the larger animal, and the character of the going.

My friend Capt. C. G. Cole Hamilton recently chased a Brown Hare with a motor car. The animal had become so confused that it rushed along a road at increasing speed, and kept ahead of the car until at 30⁵ miles an hour it was

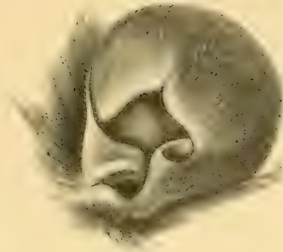
¹ Evidently a Master of Harriers; see *Field*, 15th February 1896, 258.

² Cf. above, p. 276.

³ Ernest Thompson Seton (i., 231) concludes that not only hares but greyhounds yield in pace to a blood horse.

⁴ For the facts in this paragraph, see *Field*, 29th August 1891, 332, and 6th February 1909, 214.

⁵ According to my observations at coursing meetings, a hare can continue to run at her best pace for as much as 100 seconds, but she is frequently caught in about half a minute if unable to reach covert.



(1)



(2)



(3)



(4)

THE DORMOUSE.

(1) LEFT EAR (3 times life size); (2) LEFT HAND, and (3) LEFT FOOT (both $2\frac{1}{2}$ times life size); (4) SIDE VIEW OF TAIL (life size).

forced to slip out of the way to avoid being run over. I was myself witness of the attempt of a greyhound to race a car in which I was travelling. The dog was only left behind when the speed indicator reached 37¹ miles an hour, and, allowing for the superior pace to be expected from a highly trained animal habitually used for coursing, a maximum rate of 40 to 45 miles an hour may be credited to a greyhound and of about 30 miles an hour to a hare. The pace of a hare is thus about three-fourths that of a greyhound, and nearly as fast as the average Derby winner, that race being run at an average speed of 30 to 35 miles an hour; though, were it possible to ascertain for comparison the racehorse's best sprint for a quite short distance, a very different result might be expected.²

In Fig. 49 are shown diagrammatically three types of the spoor of Irish Hares. When travelling slow (A) three of the four feet fall more or less in a straight line, and are about equidistant from each other; one hind foot is in advance, the other a little to a flank and in rear, with the two fore feet following. There is a distinct gap between each phase or group of four. As the pace increases (B) the distance between the phases is lengthened, and the phases themselves are, as it were, pulled out. At still greater speeds (C) the action changes, and each pair of fore and hind feet, markedly the latter, come down almost simultaneously; the phases thus are altered, so that the spoor resolves itself into a series of roughly paired marks at distances which are alternately double and half of each other, as explained below. The hind legs appear to propel the animal forward about twice as far as the fore legs. The diagrams show the somewhat surprising result, that the motion of the legs is more continuous and approximates more nearly to that of a wheel when the pace is slow than when it is fast; in the latter case progression resolves itself into a series of leaps, in which the fore legs try to bridge over the distance traversed by the body at each effort of the powerful hind legs, and always touch the ground (unless the

¹ I have seen a large mongrel terrier attain about 25 miles an hour.

² Much interest is also taken in the speed of foxes, cheetahs, and wild asses, the powers of the latter having been known to Arrian, who wrote in Greek about the end of the first century B.C. (*op. cit. supra*, p. 244); they are mentioned in the articles on Fox and Horse.

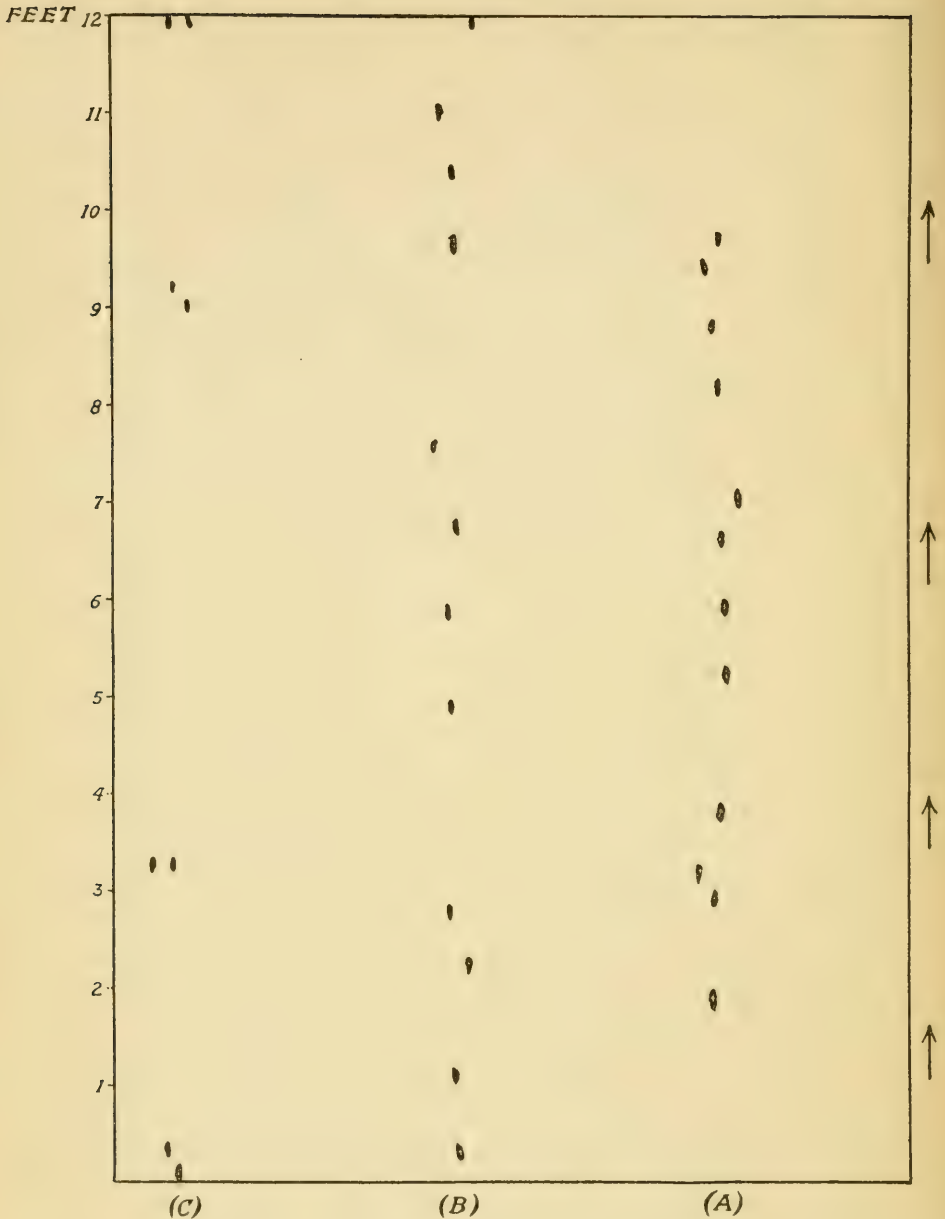


FIG. 49.—DIAGRAM OF SPOOR OF IRISH HARE, as measured on shallow snow at Kilmanock, Co. Wexford, 5th February 1912. The arrows indicate the direction.

(A) Slow. (B) Faster. (C) Fairly fast.

Length of mark of a fore foot in A, 3 inches, in B, 4 inches; ditto of a hind foot, 4.5 (A) and 5 (B) inches (length of a fore and hind foot in Rabbit, 2 and 3 inches respectively). Extreme width of track made by two fore feet, 2 inches, and by two hind feet, 5 inches.

pace is being retarded or accelerated) at two-thirds of the distance from hind-foot mark to hind-foot mark measured forwards. The order of the hind feet may be changed as in B ; the fact that they move unevenly is visible to the eye when the pace is slow, and I have seen one lifted up after the manner of a terrier dog, the hare travelling for a short distance on three legs.

I have measured a series of leaps measuring approximately 90,¹ 46, 90, 45, 86, 42, 62, 44, 86, 47, 60 and 120 inches, the average of the long and short leaps being 89 and 47 inches respectively. These do not pretend to represent the extreme speed of the animal, in which case much longer distances would no doubt be covered. I have not noticed what Mr Thompson Seton calls "spy-hops," that is, extra big leaps made for purposes of observation.

In the particular tracks figured the "triangles" of the theoretical track (see p. 169) are not so evident as in the tracks of rabbits figured above on p. 220.

It is obvious that in order to leave the spoor described above, the animal can only progress by alternate contractions and extreme extensions of its whole body, the muscles of which are thus utilised to assist those of the limbs. This method of progression has been shown by Mr Edward Muybridge² to be that of the greyhound, but the spoor of the Irish Hare indicates an extreme development of the action.

When merely wandering about at ease the length of leap may decrease until the animal halts and footmarks overlap.

The above figures may be compared with the 15-foot leaps of the Brown Hare, as described in the article on that animal,³ as well as with Dr R. W. Shufeldt's notes⁴ on two American species, of which one, the white-sided "Jack Rabbit,"⁵ clears at ordinary times 48 inches, but if pressed, 144 to 156 inches ;

¹ The combined length of the two fore and two hind feet should be deducted in order to arrive at the true length, since in each hind foot there is a space of about 150 mm. of leverage and variation of fulcrum, and in the fore limb, from the carpus to the claws (the function of which in progression is not to be underrated) about 75 mm. of leverage are found, being a total of about 225 mm. for each lateral pair of feet and the double of that for the action of all four feet. (See Joseph Gamgee, "On the Action of the Horse," *Journ. Anat. and Phys.*, May 1869, 375.)

² *Descriptive Zoopraxography*, 1893, 41.

³ See above, p. 287.

⁴ *Zoologist*, 1888, 259 ; see also Editor, *Field*, 9th November 1895, 786.

⁵ *Lepus callotis callotis* (Wagler).

while for the other, a cottontail,¹ which is in size about the equal of our own Rabbit, the corresponding figures are 24 and 72 to 84 inches ; it is not stated how these measurements were made. According to Mr Thompson Seton,² the "Snow-shoe Rabbit" of Manitoba³ clears 8 or 10 feet at a bound, and makes four bounds in a second, thus attaining a rate of over 26 miles an hour. But this is a small animal weighing only about 3 lbs. The much larger white-tailed Prairie Hare,⁴ the weight of which averages 7 or 8 and may reach 12 lbs., is said to clear commonly 18 to 21 feet, and races along at nearly 30 miles an hour.⁵ As in the case of Dr Shufeldt's observations, it is again not stated exactly how the measurements were made.

The Irish Hare if pursued frequently "goes to ground," but it digs no burrow for itself. I have seen one when coursed disappear into a rabbit's burrow and thus save its life,⁶ and on several occasions leverets have voluntarily done the same thing, or have concealed themselves in hollow tree-trunks ;⁷ I also knew two leverets which habitually lived in a rabbit's burrow.⁸ My friend, Capt. T. S. Blackwell, once bolted a hare with a ferret in the King's County ; and in the summer of 1912 my keeper thus bolted eight leverets, each aged about a month, from two burrows.

In mountains the habits are thus described :⁹—They "take to natural fissures in the rocks, or to natural courses, called by the natives water-brakes, formed by the percolation of the water through the peaty formation overlying the rock or other hard subsoil, often to a depth of several feet. In many localities, as for instance in the Bannermore chain in Donegal, where there is little covert, the hares become nearly as subterranean in their habits as rabbits. In these holes or crevices they seek safety from their enemies or shelter from bad weather, coming to the entrance of their 'burrows,' if such

¹ *Sylvilagus*, sp.?

² i., 636.

³ *L. americanus* of Erxleben.

⁴ *Lepus campestris* of Bachman.

⁵ Captain Lewis, quoted by Thompson Seton, i., 666.

⁶ There is a similar note from Co. Antrim by an anonymous writer, "R. A. A.," in *Field*, 18th July 1891, 88.

⁷ *Irish Naturalist*, 1896, 119.

⁸ *Journ. cit.*, 1901, 73.

⁹ "Aquarius," in *Field*, 8th February 1896, 185.

they may be termed, to bask in the sun,¹ their 'seats,' as they are termed, being clearly marked. It is supposed that hares took to this habit to escape from their chief enemies the eagles, formerly abundant in these mountains. . . ."

In the above quotation it is not implied that this hare may dig its own burrow. That suggestion was, however, made by S. G. Otway, who stated² that when introduced to the sandhills of the Mullet of Co. Mayo, the hares found that to obviate being buried by the sand during the storms of winter they must needs burrow or leave the district. Accordingly they made horizontal holes, perforating a high narrow sandbank from side to side. Sitting at the windward entrance they faced the storm, shifting their position backwards as the wind blew the sand away. The above story savours of romance, but it may well be founded on fact, since it is possible that the hares occupied the deserted habitations of rabbits. It would not be indeed surprising to find Irish Hares burrowing if placed in exceptional situations and amidst scarcity of cover. During the winter of 1911-1912 a number scooped out "forms" for themselves in an arable field of clay soil at Kilmanock, and lay with their backs sheltered by sometimes fully 6 inches of excavation.

This hare swims as well as its allies, and when frightened ventures to face a branch of the tidal estuary of the river Suir at Kilmanock, the width of which may be nearly a hundred yards across near its mouth. The ears are then laid back as when running at high speed, and lie close to the water. In Connemara Mr Harding Cox³ found hares on the islands of Lough Inagh, and they were always ready, if disturbed, to cross the several hundred yards of often rough water intervening between them and the mainland. The above records relate only to frightened animals, but a friend of Thompson's observed one of its own free will enter and swim across a deep pool of a mountain stream, although a short way lower down the crossing was easy. A remarkable instance of swimming was that of a doe which, in order to attend to

¹ Or, perhaps, to avoid the wet mud of the floor—see T. P. Tomes, *Field*, 25th January 1896, 139.

² *Ann. Nat. Hist.*, v., 362, 1840.

³ *Field*, 22nd September 1906, 540.

the wants of three leverets, swam every night to an island on an artificial lake.¹

Occasionally these hares lie out so close to the sea that it would seem to be not unusual for them to be cut off and to have to regain the shore by swimming. Thompson states that he twice in one day came upon hares resting on rocks usually isolated for at least half of every twelve hours.

The breeding habits, so far as has been ascertained, are similar to those of other hares. At Kilmanock young leverets may be found, like rabbits, at almost all times of the year,² so that the does must have several litters each season; and in fact Thompson found that some kept in an enclosed yard in Belfast produced young three times in a year. That writer believed that there are five litters during each season. At Kilmanock the majority of leverets begin to make their appearance in March, that is not quite so early as young rabbits.

The usual number of young was stated by Thompson to be three, which agrees with my own observations, no instance exceeding that number having come under my notice, while in three cases I found only two. Thompson was, however, informed by two gamekeepers, that they had, although rarely, observed four, and his friend William Sinclair took six out of a doe weighing 8 lbs. in May.

As in the case of other hares, the leverets are seldom found lying together in one nest, because they soon either disperse of their own accord or are separated by their mother. But it is probable that all the members of a litter are dropped in the same place, where, indeed, they may occasionally be discovered. One instance of three having been thus encountered together has come within my personal knowledge, and two others have been reported to me. On one occasion my gamekeeper kept the leverets under observation, and he found them on each subsequent day farther apart until he lost sight of them altogether. It seems likely that the young of a litter, although

¹ H. C. Dent, *Field*, 14th June 1890, 892.

² The following dates are taken at random from MS. notes, all made at Kilmanock:—female suckling, 20th January; rabbit-sized leveret, 25th January; female in young, 14th February; recently born leveret, 27th August; three embryos, October; this practically covers every month except July and September, there being no need for records from March to June.

occupying separate forms, may meet and fraternise during their hours of activity. The two leverets to which I have already alluded as having their home in a rabbit's burrow, always grazed close to each other, and when alarmed ran to the same place of refuge.

Thompson saw the young taken from their mother with their eyes open and able to run within an hour of their birth; and I can corroborate this precocious activity. Those born of captured dams readily learnt to drink milk from a saucer, but were able to dispense with it in about twelve days. In one case, when the leverets were allowed to remain with their mother, they thrived very well, and she soon became very energetic in defending them with teeth and claws. But her affection must have undergone rapid cooling, for on about the twenty-first day they lay killed and mangled, thus probably indicating that period as representing the limit to which the parental love of the hare can be extended.

I have twice in spring seen a hare chasing crows from a field, as if she resented their proximity to her young; but, although the squealing of a leveret should make an efficient natural call, it does not summon the mother to the rescue when the aggressor is a man.

Although hares are polygamous, two may often be seen grazing in company as if paired, and sometimes several such couples have been under my observation at the same time. I have watched two thus resting together for some time under the shade of a tree, one of them basking and rolling in the sun. If not merely a temporary arrangement, it is possible that the couples consisted of leverets which had remained together from their babyhood.

Irish Hares are to a certain extent gregarious, and when numerous may even congregate in parties. This may be due to the instincts of the sexual season, but it is sometimes very noticeable in winter. Thompson found it a very marked characteristic in the north of Ireland, and he repeatedly saw from one to three hundred moving together in one drove like deer. This herding together was not the result of semi-domestication, but was exhibited in a perfectly wild state when the animals were abundant. In the south of Ireland

I have observed the same propensity and can thoroughly corroborate Thompson, although I have not seen so many hares together as he did. Probably it is the natural consequence of the animals being very numerous.

The scream of the Irish Hare when in pain has not been distinguished from that of other species.¹ When newly captured and frightened or annoyed it is almost as noisy as a little pig.

The food of this species is not peculiar. Like the Brown Hare it destroys the bark of trees, and is fond of the tender shoots of many conifers. Thompson states that it has a predilection for the bark of the oak and that, if it visits a garden, the delicate leaves of pinks and carnations are, together with parsley and young plants of cabbage, broccoli, and cauliflower, its favourites.

Its flesh is always accounted excellent for the table.

SIMPLICIDENTATA.

THESE, the great majority of rodents, are characterised by the possession of a single pair of upper incisors, the enamel of which is confined to the anterior surfaces. The distance between the maxillary and mandibular tooth-rows being approximately equal, the motion of the jaws in eating is longitudinal or oblique. The incisive foramina are distinct, and not posteriorly confluent, and the bony palate is never reduced to a narrow bridge between the premolars. The fibulæ do not articulate with their calcanea.

MUSCARDINIDÆ.

DORMICE.

These are small animals of rat- or mouse-like appearance and wide **distribution**, mostly in warm countries, from England to Japan and from central Sweden through Africa. They are unknown in America, either in past or recent times. They

¹ Thompson Seton's description (i., 661) of the "loud coarse squealing" of a captured Prairie Hare (*Lepus campestris*) as being not unlike the "caw, caw, caw" of a crow, is good also for the Irish Hare.

therefore probably **originated** in the Old World, where they are of ancient standing, having existed before the separation of China and Japan, and of Europe and Africa, at least as far back as the upper Oligocene, as well as during the Miocene and Pliocene of Europe; a well-known form, named *Leithia melitensis* by Leith Adams, is found frequently in the Pleistocene of Malta.

Dormice are inhabitants of shrubs or trees. They have long, hairy, often bushy tails; large, prominent eyes; well-developed but not long ears; short fore limbs; and prehensile hands and feet. The clavicles, tibiæ, and fibulæ are as in the *Muridæ*.

Besides the common *Muscardinus* of Britain, there are in Europe three other genera, all differing from *Muscardinus* in having simple stomachs. Of these, *Glis* includes the Fat Dormouse, known to the Germans as *Der Siebenschläfer*, and to the French as *Le Loire*; when full-fed in autumn, it was considered a great delicacy by the ancient Romans. There are several other forms; all grey squirrel-like animals, about as big as rats, with bushy distichous tails; their large molars have flat crowns with complex enamel folds. They are found from the Atlantic coasts of central and southern Europe to Asia Minor, and from North Germany and Russia to Sicily, Sardinia, and northern Spain. *Eliomys* includes the Garden Dormouse, *Der Gartenschläfer* of the Germans, *Le Lérot* of the French, which, with other species, range from Belgium to Asia Minor, and from northern Germany to northern Africa, including the Balearics, Sardinia, and Sicily; they resemble *Glis*, but have the head conspicuously marked with black and white; tufted, black-banded, distichous tails; and small molars with concave crowns and indistinct enamel folds. *Dyromys* (instituted by Thomas, *Ann. Mag. Nat. Hist.*, Nov. 1907, 406, for *Muscardinus nitedula* of Pallas, 1778 = *Myoxus dryas* of Schreber, 1782) presents characters intermediate between those of *Glis* and *Eliomys*. It comprises forms distributed from Switzerland, eastern Hungary, and Greece, through Asia Minor to central Asia.

Although naturally vegetable feeders, many dormice have insectivorous propensities, and will eat birds or eggs; in

other respects their habits appear to be somewhat similar to those of *Muscardinus*, as described below.

The tail is very brittle in some forms, as in *Eliomys*, and breaks off, if seized, like that of a lizard, to the great advantage of the escaping animal (see Helm, *Zool. Garten*, July 1887, 217-219; *Zoologist*, 1888, 14-16). Thomas has shown (*Proc. Zool. Soc.*, London, 1905, ii., 491-494) that these dormice further resemble lizards in being able to regenerate their broken tails, and suggests that this power may be common to "all species," but it does not yet seem to have been demonstrated for *Muscardinus*.

The dormice have been associated with the squirrels on account of their climbing habits, and as often with the mice and rats on account of their general external resemblance and certain peculiarities of structure. But they have no close affinities with either family, and stand naturally by themselves as an intermediate group (see Forsyth Major, *Geol. Mag.*, November 1899, 492-495), being absolutely differentiated from both squirrels and mice by the number and structure of their molariform teeth, and from all other rodents in the absence of a cæcum to the large intestine. Their murine appearance may evidently be due to convergence, and is not necessarily indicative of relationship. Although climbers, they are not by that fact brought any nearer to the squirrels, and there are many arboreal forms amongst the murines. Their feet also are distinct from those of the squirrels, in which the claws are more prominent, whereas in the dormice the small claws but long digits with swollen pads enable the whole hand to be used as a grasping organ, and also break the shock of a jump.

These thickly padded feet are, however, strongly suggestive of the harvest mice (*Micromys*), as are also, to a certain extent, the ears, the valves of which are more complicated in structure than those of typical mice or of squirrels. But here, again, convergence, and not any true relationship, may be supposed, the climbing habits of *Micromys* and of *Muscardinus* being somewhat similar.

Dormice fill a quite different rôle from that of the squirrels, usually restricting themselves to creeping about in bushes and undergrowth, and not ascending high trees. They are also

both more sedentary and more sluggish, and the European forms, at least, enter a deep hibernatory sleep in winter.

GENUS MUSCARDINUS.

1829. MUSCARDINUS, Jakob Kaup, *System der Europäischen Thierwelt*, i., 139; based on *Mus avellanarius* of Linnæus.

Synonymy and classification :—The genus presents an instance of the modern tendency of restriction. It now includes only the common *M. avellanarius* of England, with its representatives in continental Europe; the larger dormice of Europe having been segregated in the genera *Glis*, *Eliomys*, and *Dyromys*.

The genus is poor in species and restricted in **distribution**. It ranges only from Wales to Asia Minor, and from central Sweden to the northern coasts of the Mediterranean, with Sicily; it is not known from the Iberian or Balkan Peninsulas.

Four species are recognised, including *M. avellanarius*. My *M. pulcher* (*Ann. and Mag. Nat. Hist.*, November 1898, 423), a brilliantly coloured form,¹ with a spot of cream-colour in front of each ear, is found in Italy from Sienna to Rome and Naples. Dehne's *M. speciosus* (*Allgemeine deutsche Naturhist. Zeitung*, Dresden, N.F., ii., 1856, 180), described from Tursi in Basilicata, south Italy, may represent a form identical with Sicilian specimens, which are remarkable for their deep colour, but are very little known; or it may prove identical with *pulcher*, in which case that name must give place to *speciosus*. *M. trapezius*, described by Miller (*Ann. Mag. Nat. Hist.*, January 1908, 69) from Khotz, near Trebizond, Turkey in Asia, has small, nearly circular auditory bullæ; it is probably the form recorded by Nehring from Scutari, and is stated by Satunin not to reach Transcaucasia.

The genus was made known from the post-Pliocene of Germany by Nehring (*Beitr. z. Anthropol. u. Urgesch. Bayerns*, 1879, ii., 234); in Britain it has been found only in the **Pliocene**, Hinton having seen a single tooth from the Forest Bed; and it is represented by *M. sansaniensis* (Lartet) in the middle Miocene of continental Europe (see Forsyth Major,

¹ As noticed by Brookes, *Natural History of Quadrupeds*, 1763, 293.

op. cit. supra, p. 350). It is a highly specialised offshoot of an ancient family, the absence of which from Ireland, Norway, and Spain, but presence in Sweden and Great Britain, stamp the present stock as recent immigrant to western Europe with low powers of dispersal, since it has not yet had time to occupy Norway or cross the Pyrenees. Its absence from Africa and the Mediterranean islands, except Sicily (where it may have been introduced), shows that it has not come from the south, whereas its presence in Italy and Sweden points to an existence of long-standing in central Europe antedating the birth of the Alps and of the Baltic. It may thus have originated somewhere in Europe, perhaps in Germany or near the Alps, as suggested by Scharff.

These dormice are all mouse-like rodents, characterised by a thick, compact body, warmly clothed with soft, dense fur; long, bushy, cylindrical, slightly prehensile tail; climbing hands and feet with rudimentary thumbs and short first toes.

They are gentle creatures, living in pairs or small colonies in thickets, where they build globular nests, in which they sleep by day, venturing abroad only at night. They are of more exclusively vegetarian diet than the members of the other European genera. During the summer months they produce two or more litters of blind and naked young, become very fat in autumn, and then fall into a deep sleep lasting, with brief intervals, until spring. They are of sedentary habits, a fact which no doubt accounts for their being without scent-producing glands. The same quality makes them very acceptable in captivity, where they thrive well and readily breed and rear young.

The brownish or ochraceous yellow coloration recalls that of the so-called "chestnut" horses, and suggests partial albinism. Judging from the young, it is a development from a former more mouse-like tint. It runs to bright buff in the Italian *M. pulcher*, can hardly be protective, and there is no reason to suppose that it is used for warning purposes.

In the **stomach** the cardiac extremity of the œsophagus has thickened glandular walls.

There are eight **mammæ**, arranged as:—pectoral 1—1, abdominal 1—1, inguinal 2—2.

The skull resembles that of the *Muridæ*, but the jugal bones are larger, sometimes recalling those of the *Sciuridæ*; the angular portions of the mandibles are bent outwards at their centres so that their lower borders bear distinct secondary angles.

There are twenty teeth, arranged as—

$$i \frac{1-1}{1-1}, c \frac{0}{0}, pm \frac{1-1}{1-1}, m \frac{3-3}{3-3} = 20.$$

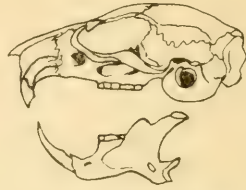


FIG. 50.—SKULL OF *Muscardinus avellanarius* ($1\frac{1}{2}$ times life size).

The premolars are small and single-rooted. The molars decrease in size from the anterior to the posterior, the anterior being distinctly the largest, and having five roots. All the cheek-teeth have flat, highly polished surfaces, through which show

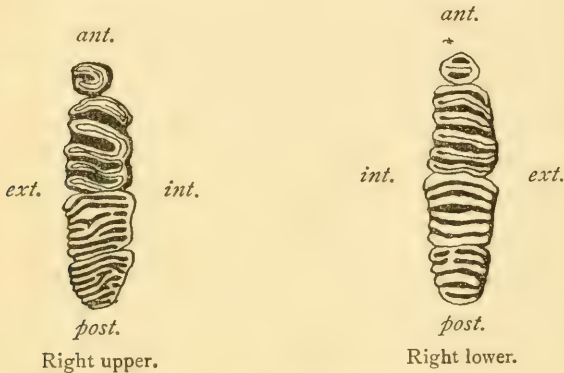


FIG. 51.—CHEEK-TEETH OF *Muscardinus avellanarius*, diagrammatic and magnified.

complex, transverse or slightly oblique enamel folds, numbering usually $\frac{2-5-7-6}{3-6-6-6}$ in the various teeth. The result is a highly complicated, rasp-like surface, unique amongst mammals, but resembling in some few respects the teeth of elephants.

THE DORMOUSE OR SLEEPER.

MUSCARDINUS AVELLANARIUS (Linnæus).

1666. *MUS AVELLANARUM*, Christopher Merrett, *Pinax*, 167; Walker; probably from Aldrovandus, *De Quadrupedibus Digitatis Viviparis*, ii., 439, 1637.

1693. *MUS AVELLANARUM MINOR*, John Ray, *Synopsis Methodica Animalium Quadrupedum*, etc., 220.

1758. MUS AVELLANARIUS, Carolus Linnæus, *Systema Naturæ*, x., 62; xii., 83, 1766; described from Upsala, Sweden; Berkenhout.
1777. SCIURUS AVELLANARIUS, J. C. R. Erxleben, *Systema Regni Animalis*, Gen. 39, sp. 16, 433.
1788. MYOXUS MUSCARDINUS, J. F. Gmelin, *Systema Naturæ*, 1, 156; renaming *Mus avellanarius*; Bingley; Turton; Kerr; Donovan.
1791. GLIS AVELLANARIUS, J. F. Blumenbach, *Handbuch der Naturgeschichte*, ed. 4, 70.
1820. MYOXUS AVELLANARIUS, A. G. Desmarest, *Mammalogie*, 295; Shaw; Fleming; Jenyns; MacGillivray; Bell, edd. i. and ii.; Keyserling and Blasius; Blasius; Clermont; Fatio.
1843. MUSCARDINUS AVELLANARIUS, J. E. Gray, *List of the Specimens of Mammalia*, 133; C. L. Reuven, *Die Myoxidæ oder Schläfer*, 1890, 69; Flower and Lydekker; Lydekker; Aflalo; Thomas, *Zoologist*, 1898, 100; Johnston; Winge; Trouessart; Millais; Miller.
1869. "MUS CORILINUM, Schreb. Sæugeth. iii., p. 835, n. 14"; Victor Fatio, *Vertébrés de la Suisse*, i., 183; but the name is not found in Schreber, and apparently originated in Albertus Magnus, *De Animalibus*, lib. xxii., 182 (ed. of 1519).
1900. MUSCARDINUS AVELLANARIUS TYPICUS, G. E. H. Barrett-Hamilton, *Proc. Zool. Soc. (London)*, 6th February, 86 = *M. avellanarius avellanarius* (Linnæus).
1900. MUSCARDINUS AVELLANARIUS ANGLICUS, G. E. H. Barrett-Hamilton, *loc. cit.*; described from Bedford Purlicus, Thornhaugh, Northamptonshire, from a specimen in full, rich winter pelage; Trouessart.

Le Muscardin of the French; *die Haselmaus* of the Germans (not *le Loire* = *der Siebenschläfer* = the Fat Dormouse = *Glis glis*; not *le Lérot* = *der Gartenschläfer* = the Garden Dormouse = *Eliomys quercinus*).

Synonymy and History:—There is no difficulty about the proper technical name for this little dormouse, which appears to have been first described by Aldrovandus in 1637. Previous to that date it was probably passed over or confused with the larger species found in continental Europe. Topsel (1658) was evidently not acquainted with it, for his chapter "Of the Dormouse" refers to *Glis*, and that "Of the Nut-mouse, Hazel-mouse, or Filbird-mouse" is headed by a drawing of *Eliomys*, and clearly deals with that animal. Although known to Merrett and Ray, it was not mentioned by Gilbert White. It appears in all Pennant's editions, and in 1758 was figured by Edwards (*Gleanings of Natural History*, chap. lvi., pl. 266, opp. p. 118).

Terminology:—*Dormouse*, plural *dormice*, from Middle English *dormous*, spelt also *dormows* or *dormouse* (15th century), is usually derived from *dorm*, used as verb and substantive in the north country, Yorkshire and Derbyshire = to doze + mouse = "doze-mouse." Although probably of earlier date, it is not known before 1425 (see *N. E. Dict.*). The word is applied also to bats, as in Gloucestershire (*Dial. Dict.*).

There being only one British species, there is no need to use an adjective to distinguish our Dormouse; but it is often called the

"Common Dormouse," and by Bewick "The Lesser Dormouse," the latter, having regard to continental species, being a quite appropriate name. Pennant calls it "The Dormouse."

Local names (non-Celtic):—*Chestlecrumb* of South Devon (*Dial. Dict.*); *derrymouse* of Devon (Bellamy), *dorymouse* of Hampshire and Cornwall (*Dial. Dict.*), and *dozing-mouse* (Forbes), are no doubt forms of 'dormouse'; *seven-sleeper* of Warwick, Hampshire, Somerset, and Devon, a term also applied to any hibernating animals, as bats, and to moths (*Dial. Dict.*), with the common German name for the Fat Dormouse, *Der Siebenschläfer*, had its origin in "The Seven Sleepers of Ephesus," a popular legend of the Middle Ages; *shrew* of West Yorkshire (*Dial. Dict.*); *sleeper* of Ray (1693), and of many districts, e.g., Shetland, Yorkshire, Northampton, Shropshire, Hertford, East Anglia, Kent, Buckinghamshire, Sussex, occurs also as *slapere* (*Dial. Dict.*); *sleep-mouse* of Berkshire, Hampshire (*Dial. Dict.*), and Surrey (Adams, MS.); *sleepy-mouse* of Buckinghamshire (Cocks, MS.).

(Celtic):—Although the animal is unknown in Ireland, Scotland, or the Isle of Man, the dictionaries give a number of names for it in the local dialects. These are either compound, such as the Manx *cadlag-gheurree* = 'winter-sleeper,' or general names for wild mice. There is naturally much confusion over the names of small mammals, the distinctions between which are imperfectly known; for instance, the Welsh *pathew* is also applied to other mice (Caton Haigh; Forrest).

Welsh:—*pathew*; cf. *cyn dewed â pathew* = 'as fat as a dormouse,' and *nid esmwyth ond pathew* = 'nothing so sleek as a dormouse'; *bathor*.

Cornish:—*bat* (Pryce).

Distribution:—This Dormouse has a rather restricted distribution, being known only from about 58° N. lat. in wooded districts of Sweden to the Alps, and from Wales at least to Galicia. It is not found in the Iberian (Cabrera, *Ann. and Mag. Nat. Hist.*, February 1900, 194) nor Balkan Peninsulas, and in Italy, Sicily, and Asia Minor is represented by other closely allied species. It ascends to 2000 feet in the Hartz Mountains (Blasius), and to over 4500 in the Alps (Fatio); Hungarian specimens in the British Museum were taken at about 3000 feet.

Where there is plenty of undergrowth, it is a common animal in **England**, south of the Midlands, including the Isle of Wight. It is widely, although locally, distributed in Wales, the western English counties, and much of the north of England, but is rare in the Midlands and strangely absent from some of the counties of the eastern plain. It does not reach the Scottish border, and the northern limit of its range is probably the county boundary between Durham and Northumberland. Even in districts where it is common, it capriciously affects certain localities to the entire exclusion of others in the near neighbourhood. Local decrease has been reported in Middlesex

(Millais); Surrey (Dalgliesh, *Zoologist*, 1906, 172; 1908, 182); Devon (Rope, *Zoologist*, 1885, 201-213, a very useful article); and Cornwall (Clark); but this may be due to the demand for captives.

In Essex it is widely distributed on suitable ground and common right up to the southern banks of the Stour (Laver), but unknown north of that river, being found only in the west (Tuck, *MS.*), and most commonly in the south-west, of Suffolk (Laver, *MS.*); Rope records it from near Ipswich, but on slender evidence. It is even scarcer in Norfolk, where, although several times mentioned¹ between 1830 and 1840, Southwell was unable to report its recent occurrence, except in the south-eastern parishes of Gillingham, Geldestone, and Stockton. In these it is common, but there was an undoubted introduction from Surrey about 1844, from which the local colony probably sprung.

Having regard to its undoubted scarcity in the neighbouring counties, the evidence is against its having been recently indigenous to Norfolk. It is scarcely better known in Lincoln; Cordeaux, although not denying its occurrence, informed Rope (*op. cit.*) that he had never met with it in the county; the sole record is that of Rudkin (*Field*, 24th May 1884, 702), who reported it from woods in the south-west, especially between Grantham and Bourn. Rudkin's observation is supported by Bolam's statement (*in lit.*), that in the years 1874 to 1877 he used occasionally to see dormice about Uppingham, Rutland.

In Leicester Browne reported it as rare; in Nottingham Whitaker could only point to two colonies in a single wood (Rope, *op. cit.*), and Lowe informs me that there is no specimen in the town museum; for Cambridge a single nest only is known, taken in 1883 near Newmarket (Rope); but these three counties and Huntingdon must surely contain some dormice, since the animal is known in Northampton (Lilford, *Zoologist*, 1885, 257; a specimen in the British Museum is from Thornhaugh, between Stamford and Peterborough), and it is plentiful in the neighbouring counties to the south. In Bedford Steele Elliot writes me that its presence is doubtful, and that, although reported from woods near Milton Bryant by Woods in 1856 (see *Zoologist*, 1885, 204), it must be extremely uncommon, even if it occurs at all. In Derby it is reported to be rare (Jourdain); while in Cheshire, perhaps, in correspondence with the scarcity of hazels, it is rare except in the extreme south, where it is more frequently

¹ The brothers Paget (*Nat. Hist. of Great Yarmouth*, 1834, 2) stated that it "is occasionally seen in small woods"; J. M[acGillivray] in a "Sketch of the Natural History of the Neighbourhood of Norwich" (*Edinb. Journ. Nat. Hist.*, ii., February 1839, 3-4), named it "among the less common quadrupeds . . . these I saw but seldom"; and Southwell was informed that it was known about 1835 to 1845. But Lubbock (*Fauna of Norfolk*, 1845), although accepting the authority of the Pagets, was unable to confirm the statement, nor was Southwell (*op. cit.*, ed. of 1879, 11; also *Field*, 29th March 1884, 447) after twenty years' observation and enquiry.

met with and may be common (Coward). It is well known in all the western counties, including Monmouth (Evansen, *MS.*; Phillips, *MS.*), excepting the hilly and north-western portions and the marshy pastures bordering the Severn, both of which districts are quite unsuitable to its wants (Banks, *MS.*). It is frequent in Stafford (Masefield, *MS.*) and Shropshire (Forrest), as it must also be in the parts of Leicester, Derby, Warwick, and Worcester adjacent to Sutton Coldfield, Birmingham, for in that locality Steele Elliot writes of it as a familiar animal; but there are other records for these counties and for Hereford (Rope).

In **Wales**, including Anglesey (Forrest), there is no county with a negative record, so that the animal is widely distributed. But, while scarce or very rare in Carnarvon (Forrest), it seems to be most frequent in the north and east, as it is common in Flint, Denbigh, Merioneth, and Montgomery (Forrest). Cardigan (Phillips, *Zoologist*, 1885, 258; Salter, *Journ. cit.*, 1903, 104), Radnor, and Glamorgan (Rope) may possibly be classed with the last four, as the records, although definite and undoubted, do not seem to be indicative of careful search. In Brecon and Carmarthen it is found very sparingly, especially in the latter (Phillips, *op. cit.*). In North Pembroke it has been taken by Bowen at Velindre, Nevern, as I am informed independently by Mills and M. J. Lewis.

In the **north of England** it is generally but very thinly distributed in Yorkshire (Roebuck, *Field*, 5th April 1884, 488, corroborated by more recent observers). Approaching the northern limit of its range the records are meagre, and in Durham it reaches its most northern known habitat in England, as recorded by Mennell and Perkins in 1864. They wrote of it as of rare occurrence, but taken occasionally in the valley of the Derwent at Gibside, Winlaton Mill, and near Ebchester. More recently a pair were observed at Headlam, between Darlington and Barnard Castle in the south of the county (Rope). For Northumberland there is no record, but the localities cited above for Durham lie so close to the county boundary that the mouse may possibly be found within its limits. In Lancashire the Dormouse is distributed locally in the west and north, Macpherson's correspondents having met with it spasmodically in a few of the more densely planted districts from the Rusland Valley to the slopes of the fells at the southern end of Windermere; and similar information was supplied by Petty (*Naturalist*, 1889, 52). In 1861 it was not infrequent near Kendal, but Macpherson was unable to trace it to the east either of Westmorland or Cumberland. In the latter county it is found chiefly in the south, and was first recorded from the Ullswater district by Heysham, and later by Hodgson. Both Hodgson and Johnson took it at Dalston, near Carlisle, about 1880 (Macpherson). Dalston is of

especial interest, because it yields to Winlaton Mills, Durham, by a few miles only in respect of being the most northerly situation in England where the Dormouse has been noticed.

The only **islands** in which the Dormouse is known are Anglesey (Forrest) and the Isle of Wight.

Since it has been found within a few miles of the Borders, there seems no reason why it should not occur in **Scotland**. But, although there are a few old records, *e.g.*, for Gifford, East Lothian (Mac-Gillivray); Careston, Forfar (*New Statist. Account, Forfarshire*, 523); and for Scotland without locality (Walker; Fleming), Alston was unsuccessful in obtaining confirmation of them, and modern Scottish naturalists are unable to give the animal a place in their fauna.

The Dormouse is quite unknown in **Ireland**. Barrington set six free at Fassaroe, Co. Wicklow, on 13th November 1885 (*Zoologist*, 1885, 479), but, as he informs me, they were never heard of again. The season of introduction was not very well timed, since the animals would probably, in a state of nature, have already commenced hibernation.

[Jonston, *Historia Animalium*, 1650-53, i., 163-64, mentions its absence from Ireland, and its inability to live elsewhere in houses built of Irish oak. Rutty (1772) brands Jonston's statement as a "vulgar error," but though he rightly describes the animal's colour, he confuses its nest with that of the Harvest Mouse, and his statement that it occurs in Ireland shows that he could not have been himself acquainted with it.]

Distribution in time:—This species is not known as a fossil in Britain.

Origin:—The absence of the Dormouse from Scotland, as well as from the hiemally coldest part of the eastern plain of England, suggests at first sight that winter cold is the governing factor in its British distribution. But that is not the case, for in the greater part of its continental range it is subjected to winter temperatures lower than any experienced in the British Isles. Since the eastern plain is the driest part of England, humidity is also ruled out. The summer temperatures may next be considered. That of Norfolk in July, is about 62° F. that of the south-east of Ireland about 60° F., but since the extreme northern limits of the animal's range, both in Britain and Sweden, lie somewhere near the July isotherms of 60° F. and 59° F., deficiency of summer heat cannot have caused the absence of dormice from East Anglia and Ireland. Further, since the next coldest July isotherm, that of 58° F., passes through Scotland some distance north of that of 59° F., the gradient between the two being shallow, it would seem quite possible that there are a number of localities suitable for dormice in the south of Scotland, where the hazel is abundant; so that climatic conditions can hardly have caused

the animal's entire absence from that country, in which it might be expected to occur locally.

It seems probable that the animal has been prevented by some barriers from reaching Ireland, Scotland, and the east of England. Its distribution, identity with continental *Muscardinus*, and absence from pleistocene deposits suggest a quite recent arrival in the south of England after the separation of Ireland; and it does not seem to have had time to enter Scotland or to cross rivers, fens, and marshes such as still cut it off from Norfolk (where it thrives well when introduced) and Suffolk. There the river Stour, with the marshes from Nayland to its mouth, appears to have been an absolute barrier to it (Laver, *M.S.*), and possibly the Tyne and its tributary, the Derwent, may have exercised a similar influence in Durham and Northumberland.

Description:—The form, skull, and general characteristics of *M. muscardinus* are those of its genus. It is a short, compact, yellowish mouse, with rather large head, raised forehead, and long whiskers; eyes bright and very prominent; ears with a ridge above the meatus, rather short, and broadly rounded; nose rather blunt; tail reaching about six-sevenths of the head and body length, thickly and evenly haired without being bushy.

The hands and feet are rather short (Plate XXII.); the thumbs rudimentary; the first toes short and clawless. The remaining digits are long with well-developed terminal pads and strong short claws; they are not very unequal in length, the fingers graduating from third to fourth, fifth to second, and the toes from fourth, third, second to fifth. There are in each hand and foot six remarkably large and swollen, but not abnormally placed pads; there being the usual four lying at the bases of the digits, including a specially large one for each rudimentary thumb and short first toe; behind the latter are a pair of large long proximal pads, of which the outer plantar is particularly elongated.

The colour of the upper side and of the anal region is brownish yellow. The tints are deepest and richest on the back (where there are some blackish hairs) and on the tail; paler on the flanks, which fade to cream or yellowish white on the under side; purer on the breast and upper neck, so as to form a whitish patch of variable size. The line of demarcation is indistinct, and passes along the cheeks slightly above the upper lip to just below each eye, thence along the flanks, leaving the internal surfaces of the limbs coloured like the belly, the external surfaces like the back. The tail is like the back above, slightly lighter below.

Nothing is known of the **moult**s. The first coat of the young, which appears dorsally on the ninth day, is mouse-grey, lacking the yellower tints of the adult except on the head or fore parts of the body; it is cast (judging from Lataste's remarks) on or about the fifteenth or sixteenth day, when a pelage closely resembling that of the adult but

with a less bushy tail is assumed; but the young are distinguishable until the spring following their birth (Bell, *ipse*), the adults being darker and more richly coloured.

In the maxillary **teeth** the premolar has normally two ridges; these are joined internally and sometimes also externally, so as to form a raised circular rim. A small third ridge may be present at the back of the tooth. The 1st molar is about twice the size of the 2nd; it is decidedly longer than broad, and narrower in front than behind; its anterior border is oblique, its inner border abruptly notched behind the first of five very distinct outstanding ridges; these (except the last) slope obliquely backwards to the inner margin, and terminate exteriorly in five low cusps, which decrease in height regularly from front to back; interiorly the first ridge alone is cusped. The three anterior ridges are more widely separated than the two posterior; the first is isolated, but the remainder meet to form a longitudinal ridge on the inner border of the tooth. The 2nd molar is only slightly longer than broad, so that its outline is nearly square; it has seven low, nearly transverse, equidistant ridges, of which the outer extremities appear as five or six low cusps; all the ridges except occasionally the third, extend right across the tooth; the posterior ones may be branched. The 3rd molar resembles the 2nd, but is smaller, and its rounded posterior border is contracted; the posterior ridges are usually incomplete and confused.

In the mandibular teeth the lower incisors have roots extending distinctly beyond those of the 3rd molars. The check-teeth resemble those of the upper jaw; but the molars show less diversity amongst themselves, each having six distinct more or less transverse ridges, the terminations of which appear as low cusps. They diminish in size from before backwards, the third being little more than half the size of the first in crown area. The first is longer than broad, and narrower in front than behind; the second is almost rectangular in outline, but rather narrower behind than in front, and slightly longer than broad; the third is much constricted posteriorly.

Individual variation is not conspicuous, but specimens with the tail tipped with white are frequently met with (as mentioned by Brookes in 1763); they are sometimes known as "lion dormice" (Adams), and are valued above the ordinary (see Rope, *Zoologist*, 1885, 212; Willmore *Journ. et ann. cit.*, 304; Parrott, *Journ. cit.*, 1887, 463). White or albinic varieties are very rare; the following may be mentioned:—one from Devon in Leach's collection (Bellamy); one, pure white, in the Borrer collection (Harting, *Field*, 17th March 1906, 433); one, wholly white with red eyes, taken alive in Kent (R. L., *Field*, 10th March 1906, 389); a pure albino from Guestling, Hastings, in the Hastings Museum; one, cream-coloured, in Whitaker's collection; three, white, in a litter of six half-grown young seen with normal mother by Owen Jones (*Field*, 22nd September 1906, 540; *Gamekeeper's Notebook*, 208).

histories of very many others, which were formerly little known, have been fully elucidated, while, speaking generally, an immense increase in our knowledge on such important subjects as Migration, Distribution, Habits, Nidification, Plumages, has accrued: And lastly, a new and important branch of study has been instituted—namely, the recognition of the various Racial Forms or Sub-species exhibited by certain birds in the British Islands, on the Continent, and elsewhere.

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It should be remarked that while it is not intended to go fully into Synonymy, yet, where changes of nomenclature have been necessary in order to conform with the Law of Priority—the only method by which complete uniformity in nomenclature can ultimately be attained—the names used in the Fourth Edition of Yarrell's "British Birds" and in Saunders' "Manual," and the Trinomial Names of the British Racial Forms, and of those occurring in Britain as visitors from the Continent, will be quoted, as will also the Original Name under which the species was described.

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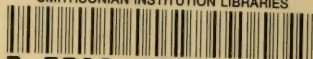
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